SHIP PRODUCIBILITY RESEARCH PROGRAM
TASK S-29

RECOMMENDED
U.S. SHIPBUILDING STANDARDS PROGRAM

LONG-RANGE PLAN

VOLUME I

FINAL REPORT

IHI MARINE TECHNOLOGY, INC.
ISHIKAWAJIMA-HARIME HEAVY INDUSTRIES CO., LTD.

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FOREWORD

This is one of several projects managed and cost shared by Bath Iron Works Corporation as part of the National Shipbuilding Research Program. The program is a cooperative effort between the Maritime Administration's Office of Advanced Ship Development and the U.S. Shipbuilding Industry.

The U.S. Shipbuilding Standards Long Range PIan recommends program for standards development for the next decade. The plan addresses the logic and basic considerations required to organize and implement operating procedures.

The task was assigned by subcontract to IHI Marine Technology of New York a division of Ishikawajima-Harima Heavy Industries Co., Ltd. of Japan. Mr. Y. Ichinose of IHI-MT directed the project. He was assisted by Mr. S. Hirano, of IHI, Aioi Japan.

Mr. John C. Mason of Bath Iron Works Corporation provided overall guidance and direction for this project. Mr. Samuel Wolkow of BIW coordinated the compilation of the background data and arranged the shipyard surveys. He also supervised the finel editing and composition of this report.

February, .1982

RECOMMENDED U.S. SHIPBUILDING STANDARDS PEOGRAM LONG-RANGE PLAN

VOLUME I - FINAL REPORT

A. EXECUTIVE SUMMARY

0.1 BACKGROUND AND TASK OBJECTIVE

During the past three yearn, a major effort has been established under the National Shipbuilding Research Program to support the development and implementation of standardization in the U.S. shipbuilding industry. While significant progress has been made during the preliminary phase of this program, it was the consensus of the program participants and other key industry representitives that expert assistanace should be solicited to formally recommend a standards long-range plan for the U.S. Shipbuilding industry. A plan that would include standard program goals, objectives, plans, priorities, and other necessary courses of action.

With this background, IHI Marine Technology, Inc., an American subsidiary of Ishikawajima-Harima Heavy Industries Co., Ltd. (IHI). Japan, was selected to perform the task as described above.

The principal objective of this task is to present a written recommmended long-range plan for the U.S. Shipbuilding Standards Program baaed upon the knowledge and experience of the Japanese shipbuilding industry, *Specifically, IHI.*

The proposed long-range plan includes recommendations placing:

— primary emphasis on near term (2-3 years) priorities and alternative courses for action to achieve maximum benefits from standardi*zation* at both indstry-wide and individual shipyard levels, and

— secondary emphasis on development of longer term (5-20 yearn) gods to serve as planning guidance for ongoing efforts

0.2 TASK REPORT — FORMAT

The task report is compiled in two volumes.

Volume I includes the executive summary, the logic and basic considerations for establishing standardization goals, how to categorize and prioritize the standards, organizational structures for development and implementation of standards, benefits of standardization end other necessary guidelines to execute the standards long-range plain

The following appendices are included for referenc:

Appendix I-A-Background Survey Summary

Appendix I-B - Standadization in the Japanese Shipbuilding Industry

Volume II summarizes the recommended long-range plan for the U.S. shipbuilding industry with specific guidelines and recommendations for implementation.

The following appendices are attached

Appendix II-A — Standards Category Tree Structure

Appendix II-B — standards Priorities

Appendix II-C — Contents of Standards Publications

Appendix II-D — Examples of System Codes

Reference material used to develop Appendix II-B (Standardization priorities) consists of a summary of existing U.S. and foreign shipbuilding standards (based on a 1979 U.S. Survey), and a listing of current U.S. Navy standard specifications.

0.3 BACKGROUND SURVEY

The task began on March 6, 1981, with a background survey of past and currant standards activities and the needs of the U.S. shipbuilding industry. A *Summarized* report is attached as Appendix I-A

Principal fidings of the survey were as follows:

— There are a great number of existing standards that can be utilized by the U.S. shipbuilding industry, but many of them are duplicated and badly need consolidation and/or unification.

— Some of the major shipyards am already introducing advanced technologies such as zone-outfitting, accuracy control etc., and are spontaneously developing their own in-house standards as required.

— -Most of the shipyards visited have expressed *Strong* desires to:

- o consolidate commerciel/navy standards
- o simplify plan approval/inspection procedures

- establish quality standards acceptable to all inspection groups
- develop a standards numbering system
- solicit full support for standardization from the government, owners, regulatory bodies, vendors/suppliers, etc.
- establish production/working standards

These findings have been taken into consideration in developing the long-range plan.

0.4 LONG-RANGE PLAN

The recommended standards long-range plan is summarized in Volume II. As the first step, a "tree structure" was established to organize and systematize standards in three basic categories, namely "national", "industry-wide" and "in-house" standards. Each category is divided into groups of standards defined by their functions, and further divided into systems or processes related to the functions.

The long-range plan was developed from this tree structure, specifically, by classifying the standards by priority, i.e. short-term, mid-term, and long-term goals.

The concept of categorizing standards into "national", "industry-wide" and "in-house" levels generally follows the standards structure adopted in Japan. However, the recommended standards long-range plan does reflect the recognized major difference between Japan and the U.S. in the "national" standards category. This important difference is explained further in Section 1.3 of Volume I.

Priority levels for development of standards are based upon the various criteria indicated. Generally, the first priority is given to those areas which involve industry-wide standards and include basic materials, fittings, and equipments that comprise the ship's various systems. Secondary priority is given to standards that evolve from the former priority level and require more time to develop, and to the consolidation of existing requirements.

Based upon this philosophy, the long-range plan addresses three development goals, namely, short-term (2-3 years), mid-term (5-7 years) and long-term goals (10-20 years).

Short-term goals place emphasis on basic product standards, functional performance standards and design/engineering standards, which are the basis for standardization of ship's systems and processes.

Mid-term standards place emphasis on longer term design/engineering standards, basic testing/inspection standards and production process standards.

Long-term standards include design/engineering standards, testing/inspection standards, production process standards, accuracy/tolerance standards, etc., all of which require more time to develop or depend on short-term and mid-term standards as prerequisites.

0.5 GUIDELINES FOR IMPLEMENTATION OF THE LONG-RANGE PLAN

The following sections summarize guidelines for implementation of the recommended long-range plan:

1) Organizational Structures

Recommended structures for development and implementation of national standards and industry standards are delineated, referring to the organizational structures adopted in Japan. Overall, the existing organizational structure for the National Shipbuilding Standards Program is readily adaptable with further participation of the government, regulatory bodies, pertinent marine industries and shipowners. SNAME (Society of Naval Architects and Marine Engineers) PANEL SP-6 on Standards and Specifications is suggested to continue core planning activities, and ASTM (American Society for Testing and Materials) Committee F-25 on Shipbuilding should remain the principal working group. Participation of ANSI (American National Standards Institute) is suggested to coordinate national standards matters.

For company levels, the organizational structure is variable, depending upon the standardization goals of the company. It is recommended that special project teams be formed under the direct control of top management to effectively implement a major program of in-house standards development.

2) Standards Development

Recommended standards items, grouped by functions and classified by short-term, mid-term and long-term priorities, are listed in Volume II, APPENDIX II-B.

It is recommended to begin development of these standards simultaneously at national, industry and

company levels, concentrating on short-term priorities.

In reviewing the APPENDIX II-B list, it must be recognized that there are, in fact, many standards that already exist and are utilized by the U.S. shipbuilding industry. A significant problem, however, is that many standards are issued by different organizations for the same area resulting in overlap, duplication and even contradiction. Therefore, it is recommended that consolidation of existing standards also be addressed as a priority goal. In particular, it is recommended that a major effort be initiated to consolidate existing Navy standards, as far as practicable, with commercial standards. There are some 12,000 standards currently referenced by the Navy, and it is conceivable that many of these could be consolidated with commercial equivalents.

3) Implementation

It must be recognized that the successful implementation of the recommended U.S. Shipbuilding Standards Program Long-Range Plan will require substantial top level support and participation by both government and industry.

Consolidation and development of National, industry voluntary and company in-house standards should proceed in a coordinated fashion within the framework of a major combined government/industry thrust.

It is recommended that SNAME Panel SP-6 on Standards and Specifications take the lead in initiating formal planning for an expanded National Shipbuilding Standards Program which can accomplish the objectives of the recommended long-range plan.

B. BACKGROUND CONSIDERATIONS AND GUIDELINES FOR STANDARDIZATION

1.1 INTRODUCTION

Standardization plays an important role in rationalizing and improving productivity in most modern industries, including the shipbuilding industry.

During the past two or three decades, advanced shipbuilding technology, such as zone-oriented production processes and work breakdown structure, modularized unit construction, computer-aided design/manufacturing (CAD/CAM), interfaced material/production control, accuracy control, etc., have been developed to increase shipbuilding productivity, with their success depending on standardization as one of the essential elements.

In order to promote standardization with maximum efficiency and benefits to the industry, it is most important to identify the standardization goals which best suit the peculiar circumstances and needs of the industry. The objective of this task is to provide a recommended long-range plan for the U.S. Shipbuilding Standards Program, based upon the knowledge and experience of standardization in the Japanese shipbuilding industry.

The guidelines described herein basically follow the Japanese approach. Although the industrial structure and responsibilities, and social circumstances surrounding the industry are somewhat different between the two countries, the fundamental philosophy of standardization is clearly adaptable.

1-2 STANDARDIZATION GOALS

1.2.1 The Basic Philosophy of Standardization in Shipping

The primary objective of standardization is to increase productivity by building products based upon a unified specification, design and production process. This concept can be easily applied to mass-production industries which manufacture high volume. Shipbuilding, however, is inherently not suitable for mass-production due to the size of ships, their complexity in structure and systems, and the variety of requirements, performances, and operating characteristics, etc. Therefore, standardization in shipbuilding must be approached with a different philosophy.

There are few opportunities to mass-produce a series of ships of identical design unless the market demand is extremely favorable to the shipbuilding industry. There is, however, a great deal of similarity and commonality in individual components and systems, and even production processes, that can be applied irrespective of the type and the size of the ships.

Therefore, in shipbuilding, a maximum effort should be concentrated on standardizing these basic areas rather than a whole ship design.

Standardization is successful only when the standards are widely used and accepted by all parties involved in the shipbuilding industry. Standards should provide full advantages and benefits to shipowners, operators, suppliers of machinery and equipment, regulatory bodies, design agents, etc., as well as the shipbuilders, by playing an important role in improving product quality, reducing cost and time by rationalizing engineering/material procurement/production processes, improvement in communication, and so forth. These benefits of standardization are summarized on the chart shown in Figure 1-1.

In a narrow sense, standards are considered as a requirement which should be conscientiously observed by the user, however, some flexibility should be permitted to facilitate application. For example, the fabrication process of a standard product should be left to the discretion of the manufacturer so that he can select the best method to attain the highest productivity. Also, the shipbuilding industry should consider standards of other pertinent industries or suppliers to supplement their own standards rather than forcing custom manufacture to specific requirements.

As mentioned previously, shipbuilding standards should be developed in steps, initiated from basic elements such as materials, components and other hardware comprising the ship's systems, and then extended to individual systems and, eventually, to a complete ship design. Also, software for design/engineering, production processes, quality assurance, etc., should be standardized to provide maximum efficiency in engineering and production. Priority levels of standards development should be decided considering the impact on the industry and the influence on future development of advanced shipbuilding technologies.

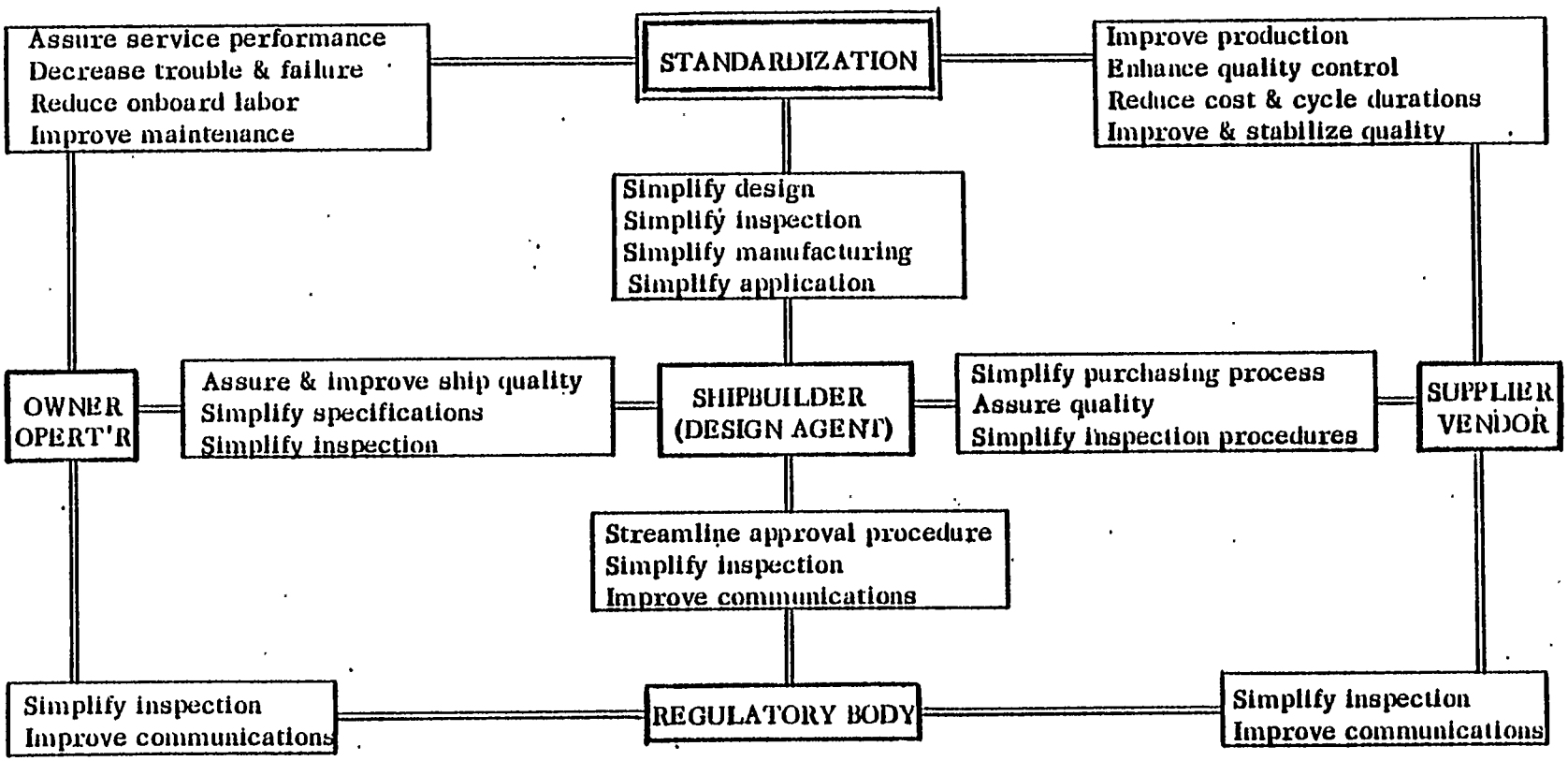


Figure 1-1 Benefits of Standardization

INSERT FIGURE 1-1

1.2.2 Shipbuilding Standardization Goals

As mentioned previously, standardization goals for shipbuilding should be planned and developed to provide full benefits to the entire shipbuilding industry including ship owners, vendors, regulatory bodies, etc. The following items indicate the goals which should be pursued:

1) **Design and Engineering**
   a) Simplification and improvement of communications between related parties
   b) Reduction of design/engineering manhours
   c) Enhance reliability of design/engineering plans
   d) Simplify approval procedures and reduce approval time
   e) Minimize design changes
   f) Improve product quality and reliability
   g) Avoid over design due to multiple requirements

2) **Purchasing**
   a) Improve communications with vendors/ suppliers
   b) Shorten delivery time
   c) Minimize custom made products
   d) Simplify purchasing procedures

3) **Vendors/Suppliers**
   a) Stabilize technical level and improve product quality
   b) Improve production methods
   c) Simplify or eliminate approval procedures
   d) Improve product reliability

4) **Inspection**
   a) Minimize repetitious inspection
   b) Eliminate overlapping and duplication of inspection by regulatory agencies
   c) Reduce inspection time/cost

5) **Product Accuracy**
   a) Unify product accuracy
   b) Improve product reliability and safety

6) **Production Methods**
   a) Improve producibility, productivity and safety
   b) Improve production methods

7) **Shipowner/Operator**
   a) Improve communications with shipyard
   b) Improve operation efficiency by applying products with proven reliability, performance and safety
   c) Improve interchangeability of components
   d) Improve ability to obtain spare parts from other than the original equipment manufacturer

8) **Regulatory Bodies/ Classification Societies**
   a) Simplify approval procedures and reduce workload
   b) Reduce testing/inspection workload
   c) Improve communication with shipyards/ vendors

1.3 CATEGORIZATION OF SHIPBUILDING STANDARDS

1.3.1 Objective of categorizing Standards

A ship consists of numerous components and hardware comprising various systems, and is constructed through many different processes from design through production. To promote standardization in a timely and effective manner, it is essential to consolidate these various elements and categorize them systematically into families or groups which have similarity or commonality in their features or functions. The categories must be appropriately defined so that the items to be standardized and their priority order for development may be easily identified. To serve this purpose, the development of a "tree structure" is a method commonly used to identify the relationship between the item and the standards category it belongs to. The "tree structure" also facilitates determination of priority orders for standardization.

1.3.2 Standards Structure

Shipbuilding standards can be structured and categorized in two different ways. One way is to categorize the standards by assessing their influence on various structural levels of the industry. For

instance, standards which require mandatory application could be enforced by governmental laws or regulations. Standards which serve as guidance or yardsticks for the industry could be established by an institute or organization representing the industry on a voluntary consensus basis. Finally, standards which only apply to individual needs could be established as appropriate by each company. This standards structure has been successfully applied in the Japanese shipbuilding industry. The first category is defined as "national standards" and is enacted by the Industrial Standardization Law under the name of Japanese Industrial Standards (JIS). The second category is defined as "industry-wide voluntary standards" established by various organizations such as the Japan Marine Standards Association, the Society of Naval Architects of Japan, etc. The third category is defined as "company in-house standards" developed individually by each shipyard. While the approach to "national" standardization differs significantly between Japan and the U.S., the same general categorization is considered applicable.

The second aspect of categorization is to divide the standards into families or groups by specific functions or process levels such as raw material, basic components, products, engineering, performance, testing/inspection, production process, accuracy, etc. This categorization is generally applicable to any industry.

1.3.3 Definition and Features of Standards

In principle, the standards structure adopted in this long-range plan generally follows the standards structure applied in Japan. The standards categories are divided into the following groups, characterized by their dominant factors.

- National standards
- Industry-wide voluntary standards
- Company in-house standards

The definition and features of respective standards are as follows:

1) National Standards

In Japan the distinction between national and industry-wide standards is clearly established. (Appendix I-B describes the Japanese structure in detail.) National standards in Japan are those developed and published within the JIS (Japanese Industrial Standards) and enacted by the governmental agency; e.g. the Minister of Transportation for Shipbuilding.

In the U.S., the definition of "national" standards is subject to various degrees of interpretation. For the purposes of the recommended shipbuilding standards long-range plan, the following definition is suggested.

First, national standards must be distinguished from the requirements of international agreement (e.g. IMCO, SOLAS, MARPOL, etc.) or requirements invoked by Federal rules and regulations (USCG, USPHS, FCC, etc.).

National standards are generally defined to include Federal agency standards or specifications (e.g. DOD, USN, MarAd, etc.) and those industry voluntary standards which have been accepted as American National Standards by ANSI. Items in this category include definitions of technical terms, codes, units, etc.; design criteria or specifications for material and equipment (e.g. navigation, life saving appliances, firefighting/protection equipment, etc.); and basic materials and components (e.g. steel, fasteners, cable, valves, flanges, etc.).

2) Industry-wide Voluntary Standards

Industry consensus standards are developed on a voluntary basis by nationally recognized organizations representing a cross-section of the various segments comprising the shipbuilding industry (e.g. ASTM, SNAME, IEEE, etc.). Industry-wide standards should be developed on a priority basis considering such factors as commonality of usage, benefits to or impact on the industry, performance and quality requirements, etc.

Items in this category include design criteria or specifications for various shipboard machinery, equipment and systems, standards for quality assurance and inspection, etc., and equipment/components widely used in the industry (e.g. ladders, manholes, mooring fittings, etc.).

It should be noted that industry-wide standards will significantly overlap the national standards category to the extent that they are adopted by government agencies or ANSI, and likewise will overlap, perhaps less significantly, the company in-house standards category.

3) Company In-House Standards

Company in-house standards are those which are developed to meet the company's particular needs.

These standards are intended to fill the gaps of the former two standards categories and/or to establish standard processes from design through production.

National standards and industry-wide voluntary standards are sometimes slightly modified to meet unique shipyard facilities or production processes and utilized as in-house standards. Also, vendors' standard machinery or equipments can be adopted as one element of in-house standards.

Items in this category include various engineering, production, quality standards, system modules, design/drafting manuals and guidance, working standards for fitting equipments, pipe fabrication, material codes and symbols, machinery foundations, etc.

Further, standards categories may be divided into the following groups, characterized by their function or process level:

- Product standards
- Design/engineering standards
- Functional performance standards
- Testing/inspection standards
- Production process standards
- Accuracy/tolerance standards

The definition and features of respective standards are as follows:

1) **Product Standards (including Standard Specifications)**

The object of product standards is to realize benefits in manufacturing or production processes by standardizing the product's specifications. By utilizing these standard products, design and purchasing departments can proceed with their work prior to formal contract award, and attain the following benefits:

a) Simplify technical evaluations and approval procedures between the buyer and the vendor or supplier.
b) The quality of the product is maintained by complying with the standard thereby simplifying testing and inspection requirements.
c) Purchasing procedures can be simplified by ordering the product simply by its standard code designation and title.
d) Vendors or suppliers can produce standard products as stock items leading to improved delivery times.
e) Standards contribute to stabilizing and improving shipbuilding methods and processes (unit outfitting, zone-outfitting, etc.)
f) Avoid over design caused by multiplicity of requirements.

Product standards promote the advantages of standardized production. In developing product standards, the product must be designed to satisfy the consensus of the users, and the benefits will increase if the producers can apply their rationalized production techniques. Therefore, product standards should be developed primarily by the manufacturers. Typical examples of product standards are anchors, anchor cables, bitts, chocks, scuttles, windows, cargo blocks, etc., covered either by national, industry-wide or in-house standards.

2) **Design/Engineering Standards**

The objective of design/engineering standards is to define the functional performance requirements and structural characteristics of the ship. Detailed systems, machinery and equipment specifications are developed from these standards. The use of design/engineering standards eliminates conflicts in engineering and specifications over design, design changes, etc., and contributes to improved quality, reliability and accuracy of the end product, as well as the reduction of design manhours. Therefore, these standards should be developed by specialists in their respective fields, and those with a high degree of commonality should be categorized as industry-wide standards, while others unique to the company needs, should be categorized as in-house standards. Typical examples of design/engineering standards are those for basic design, specifications, various support systems, e.g. bilge and ballast system, cooling system, fire extinguishing system, life saving equipment, cargo piping system, etc.

3) **Functional Performance Standards**

Functional performance standards define the design criteria and/or conditions required to maintain the product's performance, and include necessary standards and data for their application to the ship's hull, machinery or equipment.

These standards can be used for guidance at the preliminary design stage to assure performance quality and to reduce design manhours and cycle durations. These standards should be developed by the users, in collaboration with their suppliers. Typical examples of performance standards are for life boats, davits, navigation equipments (compass, etc.), desk machinery, pumps, etc.

4) **Testing/Inspection Standards**

Testing/inspection standards define the procedures and criteria for testing and inspection of products to assure quality and performance. By establishing these standards, the following ad-

vantages can be expected:

a) As the level of understanding improves and confidence is established in the inspection process, the inspection function can be reduced to a random sampling basis. This will contribute to a more effective and less costly inspection function.
b) Eliminating differences in acceptance levels between individual supervisors will help to avoid conflicts during inspections.
c) The testing and inspection by regulatory bodies can be delegated to reputable, experienced shipbuilders or vendors, or by shipbuilders to vendors.
d) Delivery/manufacturing lead times can be shortened by simplifying stringent inspection requirements.

These standards should be developed either by shipbuilders or manufacturers, on an industry basis, and those which should comply with federal regulations should be developed as national standards. Typical examples are inspection standards for machinery and equipments, standard sea trial agenda, and various shop and onboard installation tests of machinery, hull and electrical equipment.

5) Production Process Standards

Production process standards pursue the objective of standardizing production techniques to increase productivity. By applying these standards, the following advantages can be attained:

a) Proven and productive work processes and methods can be employed resulting in safer working conditions, and leading to improved reliability and quality of the end product.
b) Work processes or methods can be easily refined and improved, leading to reduction in production manhours.

Production process standards are required to rationalize and unify production processes and, therefore, should be developed by specialists in ship production technology. Standards which can be widely utilized by the whole industry could be developed as industry-wide standards, although most will be in-house standards. Typical examples are standards for main engine shafting alignment, flushing methods of piping systems, pipe fabrication process, welding procedures, etc.

6) Accuracy/Tolerance Standards

Accuracy standards define the allowable tolerances at each stage of hull construction. By establishing these standards, the shipbuilder, shipowner, vendor/supplier, regulatory bodies, etc., can use a uniform criteria for accuracy acceptance which should result in improved productivity. These acceptance levels should be developed by specialists in ship's structural requirements. Standards which can be widely used by the whole industry should be categorized as industry-wide standards or, otherwise, as in-house standards.

1.3.4 Standards Tree Structure

In developing a long-range standards plan, there are many prerequisites which should be thoroughly investigated and resolved before proceeding to the next step. Most important is to organize and systematize these numerous items into a "tree structure" to facilitate identifying the standard's characteristics, the category to which it belongs, its relationship with other standards, systems, or processes, and its priority for development. The "tree structure" designed for the U.S. shipbuilding industry is detailed in Volume II.

The "tree structure" is first divided into three basic categories; namely "national standards", "industry-wide voluntary consensus standards" and "company in-house standards". Then each category is further divided into standards groups defined by functions or processes, specifically; product standards, design/engineering standards, functional performance standards, testing/inspection standards, process standards, and so forth. Finally, each group or family is divided into specific elements characteristic of each group or family.

1.4 ESTABLISHMENT OF STANDARDS LONG-RANGE PLAN GOALS

Shipbuilding standards include a great number and a variety of items, ranging from basic components to complex and, in some cases, highly sophisticated systems. Therefore, in order to achieve the goals in a timely and effective manner, it is important to develop a long-range plan which establishes priorities and implementation procedures based upon projected impact and influence on the industry, cost returns, and other factors that affect standardization goals. As previously mentioned, the development of a "tree structure" is a prerequisite to organizing the long-range plan. Based on this "tree structure", it is recommended that the standardization plan be divided into three

development goals, i.e., short-term, mid-term and long-term goals for selecting and prioritizing the items to be standardized. The following is the recommended development plan of the three goal areas:

1) Short-Term Goals

Short-term is defined as a 2-3 year period. The standards to be developed during this period should be directed toward basic elements essential for ship's systems, such as basic materials, components, fittings or equipment, and basic design criteria, specifications, performance requirements, etc. These standards can be developed independently without interfering with the parallel development of other standards. The standards that should be developed during this period generally include:

Product standards
Functional performance standards
Design/engineering standards (basic)

2) Mid-Term Goals

Mid-term goals comprise a period of 5-7 years. The standards that should be developed during this period should be directed toward systems soft-ware which depend on short-term standards as prerequisites, or require time to develop and/or those which form the basis of other related systems or processes to be developed in the future. The standards that should be developed during this period generally include:

Design/engineering standards
Testing/inspection standards (basic)
Production Process standards (basic)

3) Long-Term Goals

The long-term goal period is 10-20 years. The standards that should be developed during this period should be directed toward software for detail engineering, production processes, accuracy, inspection, operation, etc., which require accomplishment of short-term or mid-term goals as a prerequisite. These standards also require more time for obtaining the consensus of the organizations involved.

Also, standards which are usually classified as mid-term goals, but need more time to develop due to their sophistication, can be shifted to long-term development. The types of standards to be developed during this period generally include:

Design/engineering standards
Testing/inspection standards
Production process standards
Accuracy/ tolerance standards

1.5 ASSESSMENT OF PRIORITIES FOR STANDARDS DEVELOPMENT

1.5.1 Assessment Factors

The priority order of standards development should be determined considering the following factors:

a) To what extent will the standard be utilized? (by shipbuilders, vendors?)
b) What field will benefit by using the standard? (in design, purchasing?)
c) What conditions should be satisfied prior to standardizing the item?
   For example, a standard consisting of several products will require individual products or equipments to be standardized beforehand.
d) How long will it take to develop the standard?
e) What are the implications for implementing advanced shipbuilding technology concepts, e.g. Zone-oriented production, modularized outfitting, CAD/CAM, etc.?

Priorities can be appropriately determined evaluating the above factors, and all standards categories can be assessed in the same manner.

Practical assessment procedures and the responsible organizations involved are detailed in Section 2.5.2.

1.5.2 Priority Levels of National/Industry/ Company Standards

Highest priority should be assigned to industry standards which can be developed to benefit the industry as a whole. Individual companies may modify their standards as necessary to satisfy the particular needs of their own facilities or production processes in parallel with an in-house effort to adapt and/or develop company standards.

Secondary, but still high priority, must be placed on consolidating existing national standards to eliminate duplications, contradictions and unnecessarily stringent (and costly) requirements. The consolidation and unification of U.S. Navy and commercial standards should comprise the principal element of this priority thrust.

Priorities for individual company standardization efforts should first support industry and national level development and consolidation. In parallel with this activity, the in-house standardization level of effort and priority must be decided on a case basis. To realize the full benefits of company participation in any level of standardization, it is recommended that initial involvement be organized as a special project under top management control. Each company must take early action to establish standardization policy and procedures and recognize the need to eventually establish a formal standards function, if one does not already exist. Organizational structures for standards development and implementation are discussed further in Section 1.6.

1.5.3 Priority Levels by Standards Groups

In general terms, standards groups (or families) should be prioritized considering their impact and benefits to the industry and the relationship to advanced shipbuilding technologies and productivity improvements. The following are the basic logic and principles for determining the priority order of the standards groups.

Product standards, basic design and functional performance standards are considered as short-term development areas since they form the basis for detail design/engineering/production standards and lead to the development of standard machinery/equipment modules (units), zone-outfitting, material and production control and CAD/CAM techniques. Design/engineering standards and production process standards should be correlated to facilitate implementation of these zone-oriented production techniques. Both are considered as mid/long-term development objectives since they evolve from the preceding standard groups.

Testing/inspection standards can be developed independently of other standards. Testing/inspection methods and procedures already established by rules and regulations could be standardized immediately as short-term items. Others should be developed as mid/long-term standards priorities with collaboration between the users and the suppliers. These standards lead to simplication of testing/inspection process which, in turn, reduce costs and improve delivery time.

Production process standards are closely related to most of the other standards and, therefore, should be developed in parallel as appropriate. For example, integration of CAD/CAM, integrated engineering/procurement/material and production control by zones, using computers and the "pallet system", contribute to reduction of production manhours and time from contract to delivery.

The following table summarizes the features and benefits to the industry and the priorities for development.

Type of Standards	Major Users	Benefits	Circumstances	Development Time	Priority
Product Standards	Shipyard Vendor Regulatory Bodies	Design Purchasing Inspection	Can be developed independently	Short	Short-term
Functional Performance Standards	Shipyard Vendor Regulatory Bodies	Design Purchasing Inspection	Can be developed independently	Short	Short-term
Design/Engineering Standards	Shipyard	Design Production	Should be based on proven standardized products	Need time to coordinate within industry or company	Short-term & Mid-term
Testing/Inspection Standards	Shipyard, Vendor, Shipowner Regulatory Bodies	Inspection Production	No restraints	Need time for coordination with the groups concerned	Mid-term & Long-term
Production Process Standards Accuracy Standards	Shipyard Shipowner Regulatory Bodies	Production Inspection	Will be enhanced if products/functional/design standards, etc.are established	Need time for coordination with the groups concerned	Mid-term & Long-term

1.6 ORGANIZATIONAL STRUCTURES FOR STANDARDS DEVELOPMENT AND IMPLEMENTATION

1.6.1 Functional Requirements

To develop and implement standardization based upon the recommended standards long-range plan, it is essential to establish an organizational structure to assume the responsibility for planning, development, implementation and maintenance of the standards. This structure is required for each standards category level, namely, national, industry and company levels.

The major functions required for each organizational structure are as follows:

- Planning and assessment of the recommended standards long-range plan
- Development/consolidation of standards
- Approval of standards
- Publication of standards
- Follow-up and maintenance of standards

To establish these functions, the responsible organization must have the authority and capability to organize and control various groups to develop and maintain the standards. Particularly in the case of national and/or industry levels, an organization representing all parties interested in the standard to be developed is required.

1.6.2 Procedures for Standards Development and Maintenance

Regardless of the category the standards belong to, the standardization procedure must follow the following process:

1) **Planning**
   - Survey of items to be standardized
   - Development of a standards long-range plan based upon the survey results

2) **Development**
   - Drafting of the first proposal of the standard specification, drawings, etc.
   - Technical evaluations of the draft proposal
   - Amend and finalize the draft

3) **Approval**
   - Review of final draft at various levels
   - Approval

4) **Publication**
   - Printing, publication and distribution

5) **Maintenance**
   - Survey of standard's utilization by the industry
   - Revise standards based upon comments/feedback
   - Review standards at established intervals

1.6.3 Functional Organization

The core of standardization work is the functional organization which actually conducts the planning, development, approval, publication, and maintenance of standards. The organization must represent the consenus of the industry and should possess the highest knowledge and experience to develop and evaluate the standards from a technical viewpoint. The achievement of standardization is fundamentally dependent upon the performance of the functional organization.

The functions required are:

- Planning, deliberation and determination of the standards long-range plan
- Planning, deliberation of annual development plans
- Preparation of original drafts of standards, and deliberation of drafts

To fulfill these functional requirements, the organization should fit within an overall structure for standardization at various levels. The following general structure is recommended for this purpose:

1) **Standards Committee**

The Standards Committee should be the prevailing committee among the task groups, and its members should include all chairmen of the Subcommittees organized under the Standards Committee, and other personnel specially selected and assigned to serve the purpose of the committee. The tasks assigned to this committee are:

- Deliberation and determination of the standards long-range plan
- Deliberation and approval of annual development plans
- Final approval of individual standards drafts

2) **Subcommittees**

Technical subcommittees should be organized under the Standards Committee to undertake the tasks categorized in specialty fields (e.g. coatings, machinery, piping). The subcommittee members should include all chairmen of the Task Groups

organized under each subcommittee, and other personnel specially selected and assigned to serve the purpose of the committee. The tasks assigned to this sub-committee are:

- — Planning in accordance with the standards long-range plan
- — Development of the annual development plan
- — Deliberation and interim approval of individual standards drafts

3) Task Groups

Task Groups should be organized under each Technical Subcommittee to undertake basic tasks of standards development, and their members should represent experts in each field relative to the standards. The tasks assigned to this group are:

- — Basic surveys, drafting, input to the standards long-range plans
- — Preparation of individual standards drafts (specifications, drawings, etc.)

Each of the above groups should include specialists representing shipbuilders, shipowners, suppliers/vendors, regulatory bodies, government agents, persons of learning and experience.

At company levels, the structure of the standards organization cannot be distinctly delineated since it depends upon the capacity and size of the shipyard. Large shipyards may be able to establish special full time committees, but, generally, medium or small shipyards simply do not have enough personnel to undertake off-line tasks.

In large shipyards, a structure similar to that for national/industry standards could be established within the company. For instance, the Standards Committee could be formed by management levels of engineering and production fields to determine long-range and annual development plans. Subcommittees could be established including experienced personnel from each field to review and approve standards drafts. These committee members can participate part time without disrupting their routine jobs. The Task Groups could be formed as project teams, specially assigned to undertake the drafting and documentation of standards on a full time basis.

Shipyards which do not have such a capability must consider alternative approaches. For instance, for small shipyards, one alternative is to promote standardization as part of the routine work by line engineers instead of assigning a special team to concentrate on standardization. This kind of organization is often difficult to control. Top management must take the initiative to establish standardization goals and encourage line managers to achieve the goals. Also, it is desirable to form a small standards maintenance group of 2-3 people under the control of the top management to coordinate standards development within the shipyard, and to handle filing and maintenance of the standards.

1.6.4 Organizational Structure of Shipbuilding Standards in Japan

As detailed in APPENDIX I-B, standardization in the Japanese shipbuilding industry was initiated in the late 1940's, at national and industry levels. The categories of standards currently applied are national standards (JIS-F), industry-wide voluntary standards (JMS, etc.) and private company in-house standards of individual shipyards. Since in-house standards are developed by an organizational structure uniquely devised to suit their individual needs, a single "typical" structure cannot be cited. Therefore, IHI's organization is used as an example.

A. National Shipbuilding Standards (JIS-F)

The Japanese national standards are defined as Japanese Industrial Standards (JIS), covering all major industrial aspects, and are enacted by the Japanese Government under the Industrial Standardization Law. JIS standards for shipbuilding are coded with the symbol "JIS-F".

The procedure of establishing JIS standards is shown in Figure 1-2. In principal, the Minister responsible for the specific industry refers the planning and development of standards to the Japanese Industrial Standards Committee (JISC), which is designated under the law and attached to the Ministry of International Trade and Industry (MITI), and standards deliberated and approved by JISC are enacted under the law by the responsible Minister. JISC consists of representatives of the pertinent industries (or suppliers), consumers (or users), vendors, persons of learning and experience (universities, institutes, etc.) and relevant government agents composing a General Assembly, a Standards Council and 29 Divisional Councils, classified into specialized fields. Each Divisional Council has several Technical Committees as task groups.

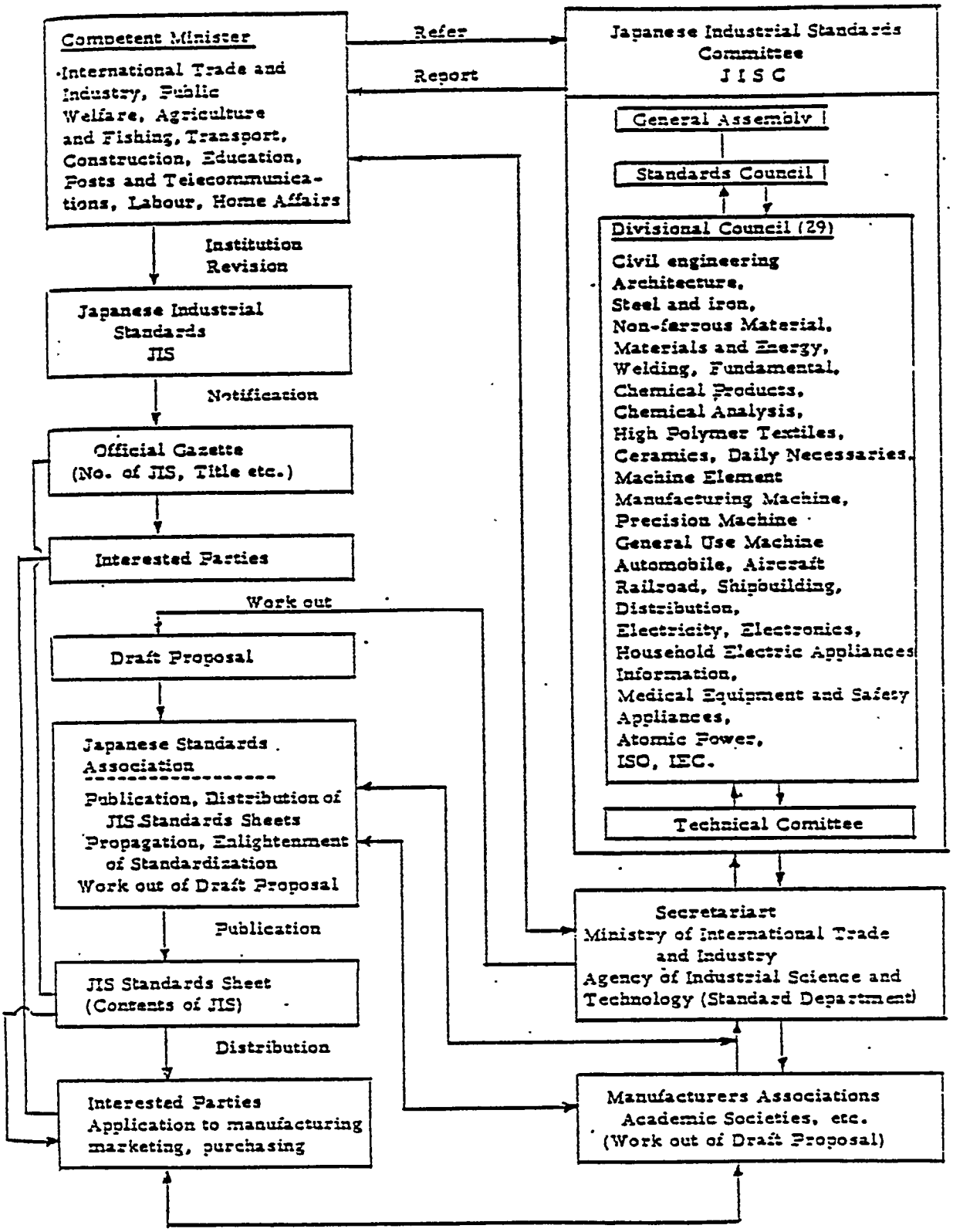


Figure 1-2 Procedure of Establishing JIS

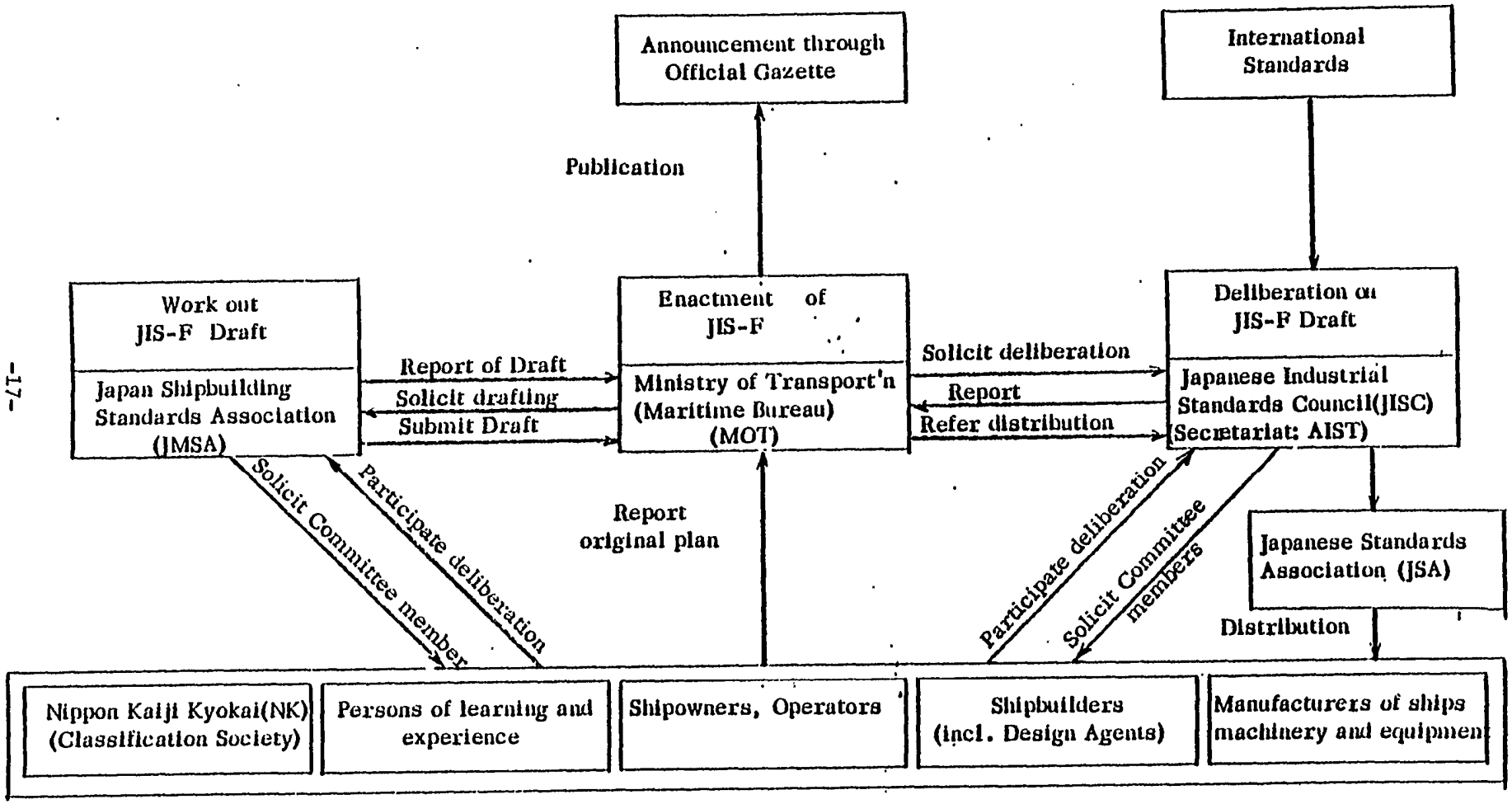
In the case of shipbuilding, the Japan Marine Standards Association (JMSA) is entrusted by the Minister of Transportation (MOT) to undertake development of the original drafts of JIS-F standards. JMSA is a private organization which is responsible for promoting standardization synthetically for the shipbuilding industry and consists of committee members representing shipbuilders, shipowners, pertinent marine industries, persons of learning and experience, classification society, etc. The original drafts of standards are submitted to JISC's Shipbuilding Divisional Council for deliberation, and upon their approval, the standards are enacted as JIS-F by MOT and publicized nationwide through the National Gazette.

Standards thus enacted are transferred to the Agency of Industrial Science and Technology, (AIST) Standards Dept., acting as a Secretariat for the JISC, and printed and distributed publicly through the Japan Standards Association (JSA) which is a private organization under the control of AIST. Figure 1-3 show the organizational flow chart of JIS-F development.

B) Industry-Wide Shipbuilding Standards

JMSA is a private organization entrusted by the Japanese Government to synthetically promote standardization for the shipbuilding industry, and their standards are coded as "JMS". JMSA has a committee composed of representatives of shipbuilders, shipowners, pertinent marine industries, persons of learning and experience, classification society, etc., which plans the development program of industry voluntary standards, and deliberates original drafts of standards drafted by their subcommittees. JMA standards, thus approved, are enacted by the chairman of JMSA, and printed and publicized. JMS is distinguished from JIS-F by its objective which covers products or objects that need resiliency in application. JMS are selected and established by the same members of JIS-F, and, thereby, there is no duplication or conflict between JIS-F and JMS. Figure 1-4 shows work flow of JMS.

Figure 1-3 Work Flow & Organizational Chart for JIS-F

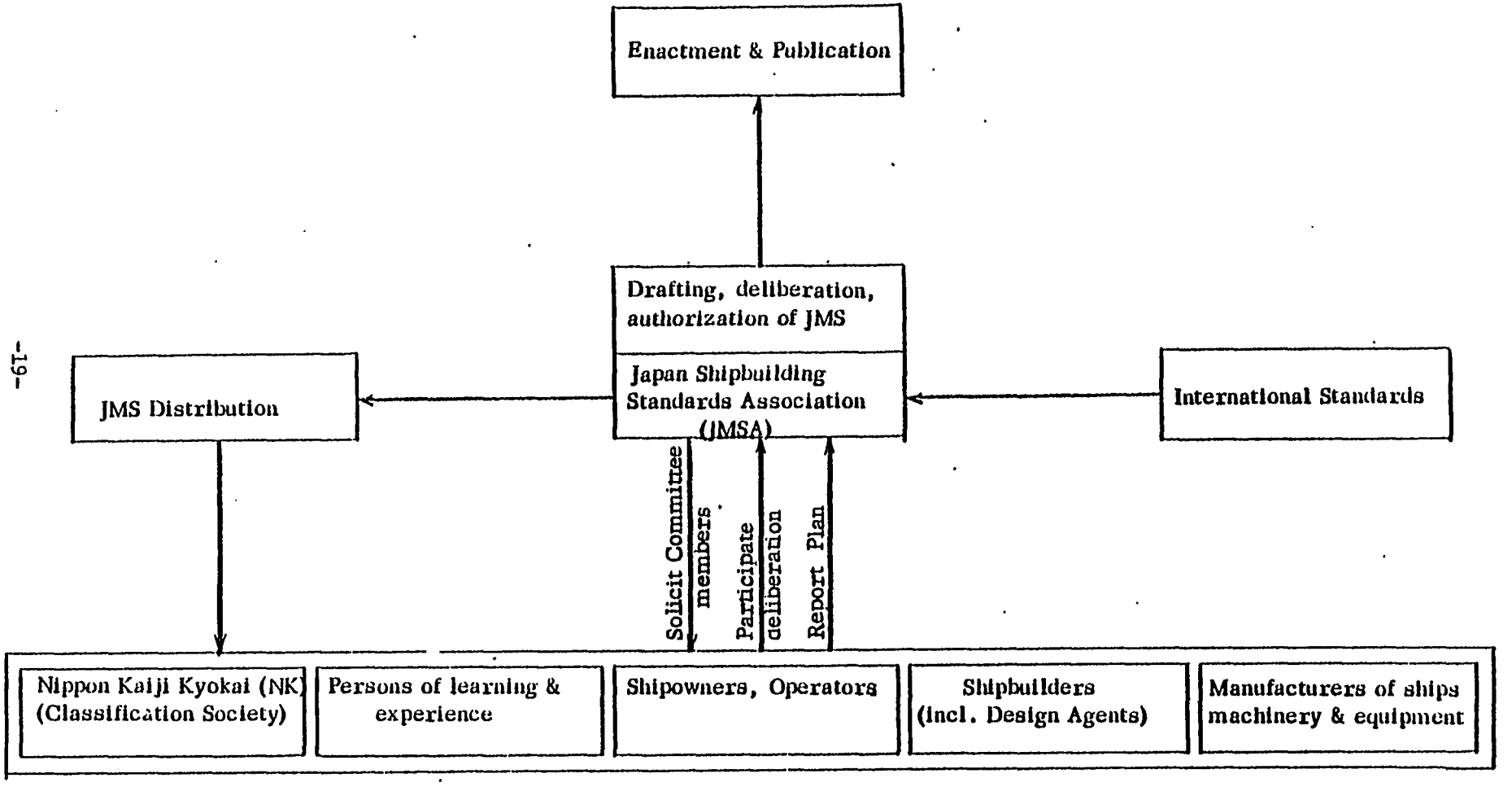


Apart from JMSA, there are other organizations which issue voluntary standards for the industry, such as:

- Japan Shipbuilders Association (JSA)
- The Ship Machinery Manufacturer Association of Japan (SMMAJ)
- The Society of Naval Architects of Japan (SNAJ)
- The Marine Engineering Society in Japan (MESJ)
- Japan Electrical Manufacturers' Association (JEMA)
- Japan Cable Manufacturers' Association (JCS)

The standards issued by these organizations usually serve as the basis of engineering, functional performance, standard machinery/equipment specifications, inspection, etc., supplementing JIS or JMS standards. Most of these standards are included in company in-house standards per se or modified, if necessary, to meet specific requirements.

Figure 1-4 Work Flow & Organizational Chart of JMSA Standards (JMS)



C) Company In-House Standards

The scope of standardization is quite different between individual companies and, consequently, the organizational structure for standards development will vary, depending upon their standardization goals, company size, etc.

The organizational structure, described herein, is the structure adopted by IHI's Shipbuilding Division, which represents one of the largest standardization efforts in the Japanese shipbuilding industry.

Standardization in IHI has proceeded in three phases, as follows:

1) Phase 1 (1966-1972)

Development of new standards, (product, functional performance, design/ engineering, testing/ inspection, production/accuracy), establishment of material codes, computerization including material control.

2) Phase 2 (1973-1976)

Maintenance of standards and development of standards, continuing from Phase 1, (production, accuracy).

3) Phase 3 (1976-)

Standards' maintenance, including revisions of existing standards to meet new requirements or revisions of international standards, rules and regulations, and development and standardization of new fittings, machinery, equipment and systems.

Figure 1-5 shows the organization chart when standards development was at its peak (Phase 1), and Figure 1-6 shows the current organization chart where the major effort is focused on maintenance of existing standards.

The standardization effort is administered and controlled by the Technical Department of the Shipbuilding Division Headquarters in Tokyo, and the Management Committee, which utilizes the routine Department Managers' Assembly of each different field, promotes the standards development by assigning various sub-committees of specialized areas to undertake the work. Sub-committee members are selected from the routine engineering and production line of each shipyard. Drafting of the standards and/or maintenance are undertaken by a Standards Group belonging to the Design Department of each shipyard.

Figure 1-5 Organization Chart of IHI's Standardization Activity (Phase 1)

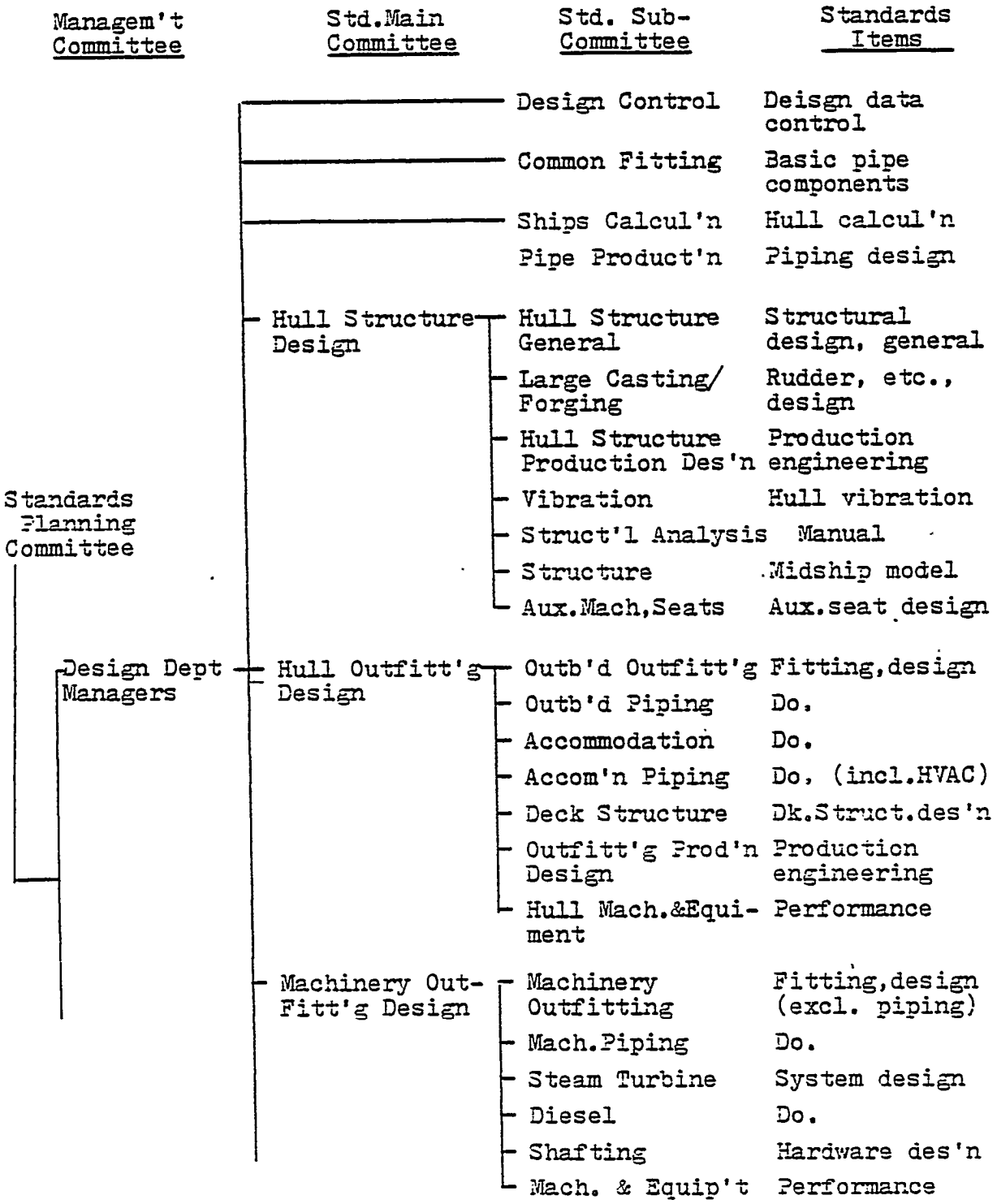


Figure 1-5 (cont'd)

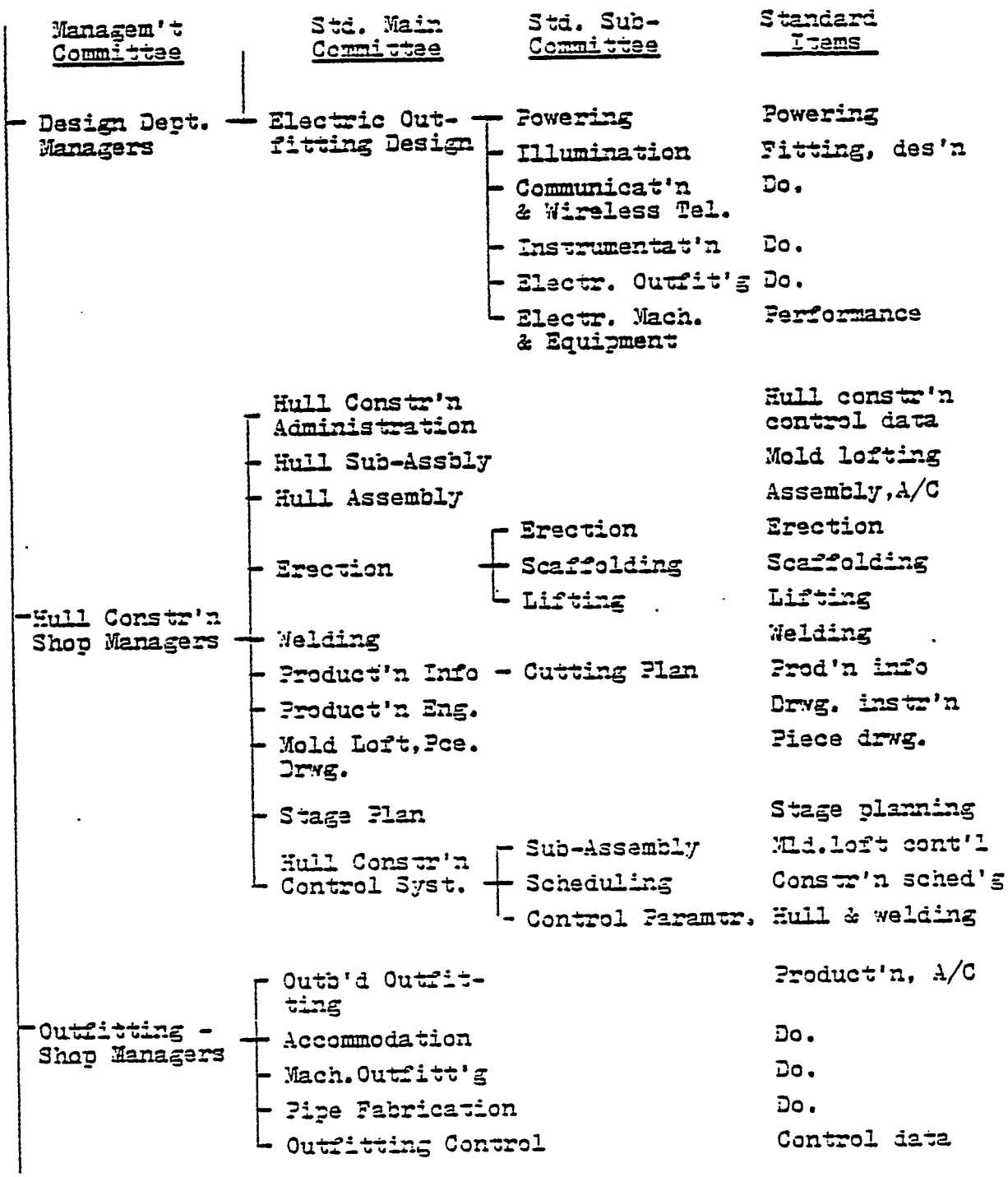
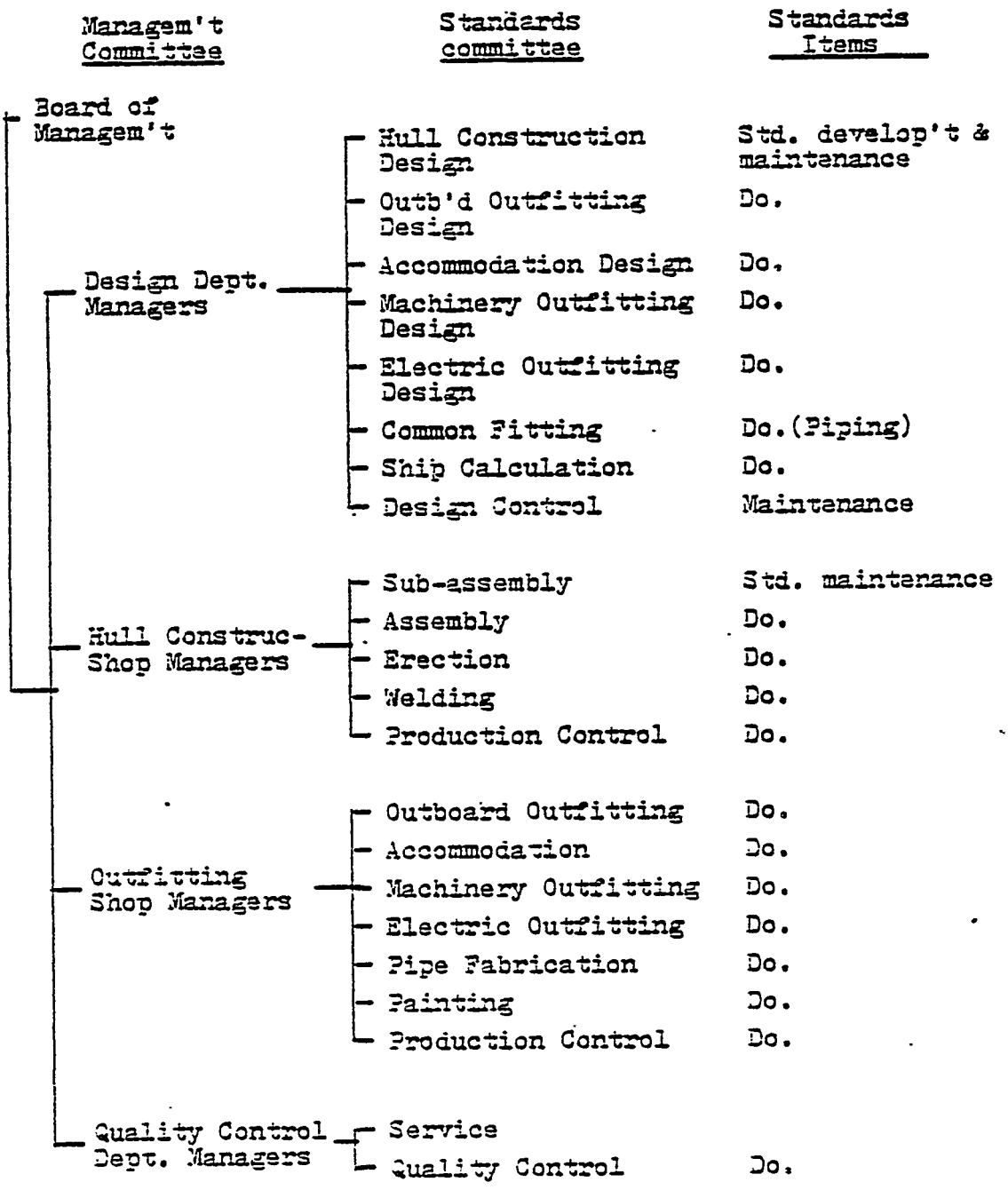


Figure 1-5 (cont'd)

Managem't Committee	Std. Main Committee	Std. Sub-Committee	Standards Items
Paint Shop Managers	Painting		Painting method
	Special Painting		Do. exotic
	Paint Standard		Specification, process
	Paint Production Control		Control data
Quality Control Dept. Mgrs.	Service		
	Hull Construction Q/C		Testing/inspection
	Hull Outfitting Q/C		Do.
	Machinery Outfiting Q/A		Do.
	Electric Outfiting Q/C		Do.
	Receival Inspection		Do.
Unification Material Control of Fitting	Outfitting		Material control
	Design		Do.
	Computer		Do.
	Production		Do.
	Oufitting Material Code		Coding

Figure 1-6 Organization Chart of IHI's Standardization Activity (Current)



1.7 BENEFITS OF STANDARDIZATION

1.7.1 Effects on Productivity

Many of the advantages and benefits to the various elements of the shipbuilding industry resulting from standardization have been already described in Section 1.2.

The direct benefits of standardization become even more significant when one considers the important contribution to implementation of advanced technologies which eventually lead to improvement in productivity. The following indicate some of the most productive shipbuilding technologies which require standardization as an essential element.

1) Outfit Units/Modules

Outfit units and modules are combinations of basic components assembled into suitable packages to facilitate pre-outfitting in-shop or on-block before erection on the building berth. Product standards provide the basis for module design, and design standards define the optimum scope and size of modules. Production standards support efficient implementation of modularization.

Outfit units or modules also facilitate establishment of effective work packages (pallets), material control, production/labor planning and control, computerization.

2) Zone-Oriented Production and Product-Oriented Work Breakdown Structure PWBS

Zone-oriented production is a production system based on geographic work zones instead of systems. Product-oriented Work Breakdown Structure (PWBS) extends the basic philosophy of Zone-oriented production defining the production process by zone, stage and problem areas, evolving from modularization.

3) Computer-Aided Design/Manufacturing (CAD/CAM)

Computer-aided design and manufacturing is not only facilitated by, but requires standardization. Product standards and design standards can be stored in the data bank, simplifying programming and processing.

4) Rationalization of Procurement

Product standards, functional performance standards, testing/inspection standards all promote common understanding between the buyer and the suppliers, and greatly simplify the approval and testing processes, leading to reduction in cost and delivery time. The adoption of manufacturers' standard products where possible will significantly reduce lead times and free critical engineering/procurement manpower to address priority areas.

5) Accuracy Control

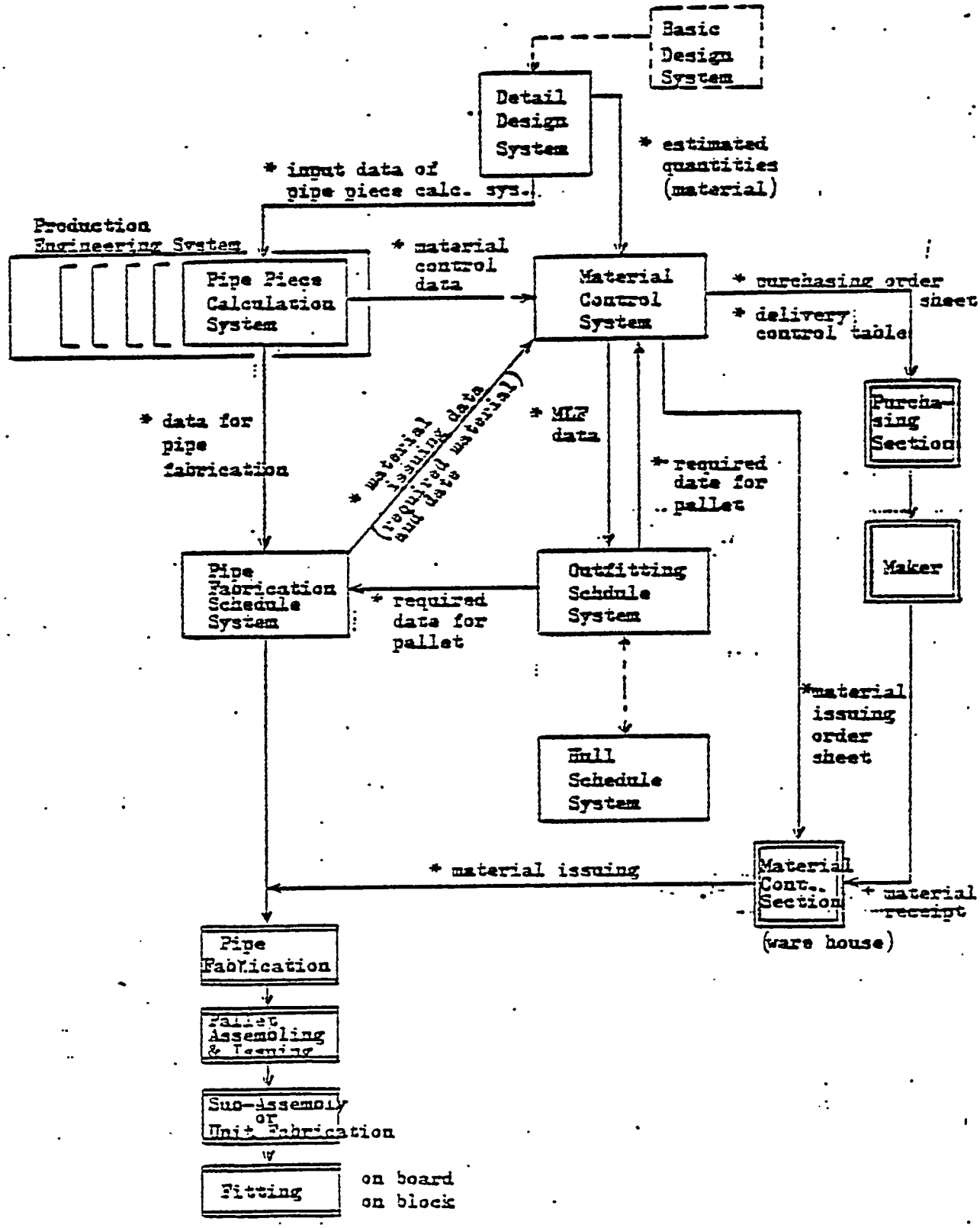
Accuracy and tolerance standards assure the quality of workmanship to the buyer and inspectors. Accuracy control reduces or eliminates geometrical inaccuracy of ship structure during each work process resulting in significant improvements in productivity and safety, particularly at erection.

6) Computerized Material Control

Material Control should be a computerized, comprehensive program which interrelates design, material control, production scheduling and accounting. By using this approach, key elements of production control can be associated with material purchasing. While it would be ideal to have all materials standardized, this is practically impossible, therefore, the material control system must be programmed to handle all materials including those unstandardized. Obviously, standards will greatly simplify the programming and reduce the computer workload.

Figure 2-5 shows the system flow chart of IHI's Material Control System for reference.

Figure 2-5 PRODUCTION CONTROL TOTAL SYSTEM
(OUTFITTING FIELD)



1.7.2 Economic Effects

Standardization is not justifiable unless the cost and time invested results in an adequate and tangible return. Therefore, it is essential to assess projected cost and time savings appropriately as standards are being developed within the framework of the long range plan.

Assessment of economic benefits is sometimes difficult since standardization involves many direct and indirect factors. For example, it is easy to assess cost returns on a single standardized product or a series of products completely standardized, but it is difficult to assess products or processes which are mixtures of standardized and unstandardized products, or when secondary benefits are involved, such as reduction in delivery time, storage time, simplification of testing and inspection, reducing maintenance costs, and so forth. The economic effects of the latter case can often only be assessed qualitatively, also recognizing that it takes a certain time to realize the benefits. Regretfully, there is no established format at this time for assessing these effects, regardless of the standardization approach.

However, the factors which commonly constitute profitable cost returns are as follows:

- Reduction of manhours (engineering, production)
- Shortening manufacturing and delivery time
- Reduction in cost
- Reduction in drawing submittals, communication costs, changes
- Reduction in maintenance costs

Therefore, depending on the type of standards, the benefits usually relate to one of the above factors.

The following are some examples of the effects of standardization, which could be assessed quantitatively:

1) Reduction of Manhours

The engineering manhours required for design and purchasing, (e.g. planning, specifications, manufacturing drawings for sub-contractors, etc.) have been reduced substantially by using standard products, standard drawings and the utilization of a computerized material control system. The following table shows the reduction of engineering manhours expended annually for hull design in one IHI shipyard:

Year	1973	1974	1975	1976	1977	1978
Eng.Mhrs./Month	43,900	42,959	35,650	31,600	29,950	19,700

2) Reduction in Manufacturing/Delivery Time

Bollards (double bitts) took 90 days to design and manufacturer when they were designed for each application. This was reduced to 40 days by standardizing material, shape and dimensions. (IHI)

3) Reduction in Manufacturing Costs

a) The costs of pipe flanges, bolts, packing, etc., were reduced by 50% by standardization. (IHI)

b) The manufacturing costs of Engineer's Day Oil Tank were reduced by 75% by standardization. (The first ASTM F-25 standard developed and published in the U.S.)

SHIP PRODUCIBILITY RESEARCH PROGRAM
TASK S-29

RECOMMENDED U.S. SHIPBUILDING STANDARDS PROGRAM

LONG-RANGE PLAN

VOLUME I

FINAL REPORT

APPENDICES

IHI *MARINE* TECHNOLOGY, INC.
ISHIKAWAJIMA HARIMA HEAVY INDUSTRIES CO., LTD.

U. S. SHIPBUILDING STANDARDS PROGRAM

LONG-RANGE PLAN

VOLUME I

APPENDIX I-A

BACKGROUND SURVEY RESULTS

U. S. SHIPBUILDING STANDARDS PROGRAM

LONG-RANGE PLAN

VOLUME I

APPENDIX I-B

APPROACH *TO STANDARDS APPLICATION IN JAPANESE SHIPBUILDING*

BACKGROUND SURVEY MEETING

1. Meeting Dates:

a)	March 9, 1981, at	ASTM, Philadelphia
b)	March 10, thru 12, 1981, at	BIW, Bath, Maine
c)	March 16, 17, 1981, at	Newport News Shipbuilding Newport News, Virginia
d)	March 18, 1981, at	Avondale Shipyards, Inc. New Orleans, Louisiana
e)	March 19, 1981, at	Peterson Builders, Inc., with Bay Shipbuilding Corporation, Sturgeon Bay, Wisconsin

2. Attendees:

a)	ASTM Committee F-25:	R. J. Taylor (EXXON) E. J. Otth (NAVSEA) B. J. Walsh (NAVSEA) H. F. Greiner N. Stiglich J. E. DeMartini (ASTM)
	MARAD:	R. W. Schaffran
	BIW:	J. C. Mason S. Wolkow
	IMT:	Y. Ichinose
	IHI:	S. Hirano
b)	BIW:	J. C. Mason S. Wolkow J. Fortin P. E. Jaquith (Partially)
	IMT:	Y. Ichinose
	IHI:	S. Hirano
c)	Newport News:	R. L. Harrington C. W. Coward R. C. Moore (R. S. Oglesby and others attended partially)

	BIW:	S. Wolkow
	IMT:	Y. Ichinose
	IHI:	S. Hirano
d)	Avondale:	S. H. Bailey J. Carlantonio R. Harris K. Ogawa (IHI Consultant Engr.)
	BIW:	S. Wolkow
	IMT:	Y. Ichinose
	IHI:	S. Hirano
3)	Peterson:	E. Peterson J. J. Goodwin J. Angerer R. Dejardini D. A. Washborn J. Gagnon F. McGrath
	Bay:	W. T. Harder
	BIW:	S. Wolkow
	IMT:	Y. Ichinose
	IHI:	S. Hirano

1.1 BACKGROUND SURVEY RESULTS

In order to provide maximum benefit to the shipbuilding and marine industry through standardization, it is necessary to incorporate practical solutions to the existing problems faced by the users in establishing standardization goals and development processes. The survey was conducted to identify the status and the needs of the U.S. shipbuilding industry.

After receiving general advice on the task objectives from the BIW Program Office and ASTM Committee F-25, the IMT survey team had meetings with four SNAME Panel SP-6 member shipyards (Newport News, Avondale, Peterson, Bay) to discuss and clarify their concerns. Generally, the shipyards visited understood the necessity of standardization and useful suggestions were made to our approach.

The following summarize the results of the background survey including the surveys on various reports of the National Shipbuilding Standards Program tasks.

1.1.1 Status Quo of Standards Utilization in the U.S. Shipbuilding Industry

As a matter of fact, there are many standards currently existing in U.S. which are being used or referred to in shipbuilding contracts and/or ship production technology. Regretfully, however, these standards are not effectively utilized since they are not consolidated/properly controlled, and further, many standards are duplicated with conflicting requirements, and are sometimes obsolete relative to the state-of-the-art. This results in confusion for the users and the standards are eventually disregarded. On the other hand, there are standards used by other industries which could be applicable to shipbuilding.

Recently, however, standardization is being recognized as a significant element for productivity improvement, and the shipyards that have used the new standards developed under the National Shipbuilding Standards Program (e.g. 5 & 10 gal. Dispensing Tank) have realized substantial cost/time savings.

Further, several U.S. shipyards are introducing Zone-outfitting, accuracy control and other advanced production technology, and to realize the full potential of these techniques, they are spontaneously establishing their own in-house standards, and incorporating these standards in the contract specifications.

1.1.2 Problems Currently Faced by the U.S. Shipbuilding Industry (from a Standardization Viewpoint)

While the U.S. shipbuilding industry faces many problems in applying existing standards, an effort is being made to correct the situation. Undoubtedly, the development of new shipbuilding standards will contribute significantly to problem resolution. The key problems identified during the background survey are summarized as follows:

1) Duplication of Standards and Criteria

There are many standards and criteria existing in the U.S., such as ASTM, ASME, Military, Coast Guard, Maritime Administration, etc., and in many cases, the requirements for a single item or system are duplicated or contradictory resulting in confusion and costly inefficiency. The principal problem is that there is no single organization working to consolidate standards and specifications.

2) Approval Procedures

Due to the lack of unified standards or criteria, many requirements remain unclear between the shipbuilder and shipowners, classification societies, regulatory bodies (Coast Guard, etc.), design agents and vendors, and consequently, the shipyard is required to repeat the drawing submittal/approval cycle for each construction contract. Since the number of approval plans is excessive, the review and approval is usually delayed. Frequently, plans for the same equipment or systems are required to be submitted to the regulatory agency (USCG) and the classification society (ABS) for approval. Conflicting requirements/comments from these organizations are time consuming to resolve and disruptive to the production schedule of the shipyard resulting in significant losses in time and money.

3) Inspection Structure

The division of responsibility for the scope and degree of the inspection activity is often vague and ambiguous and results in differing interpretations as to what is an acceptable inspection criteria amongst the classification societies, regulatory agencies, shipbuilder, owners and design agents. The outcome of this confusing situation is repeated inspections of a single item or system which disrupts the inspection/completion schedule causing delays in production/delivery.

4) Quality Acceptance Levels

As is the case with the inspection process, the

quality acceptance level is not clearly defined. This situation is particularly evident in such areas as welding quality, hull construction structural tolerances, painting surface preparation and system applications, cosmetic repairs, etc. Empirical standards developed over a long period of time by individual shipyards are generally not accepted by owners/regulatory body inspectors who have their own ideas of what the acceptable quality level should comprise. This leads to delays, adversary relationships and excessive costly rework by the shipbuilder.

5) Vendors/Suppliers Support

Generally, most U.S. vendors or suppliers of marine equipment have a major market in other industries and an insignificant market in shipbuilding. Therefore, the shipyard must use equipment designed for other than marine application, or have it custom manufactured for a particular application. Under these circumstances, shipyards find it difficult, time consuming and costly to purchase equipment which satisfies their requirements. Vendors are often reluctant to accept orders on such a basis, and when they do, manufacturing lead times are usually very long.

This problem may be attributed to (1) the lack of standardized specification for purchasing in the shipyard, (2) failure to use manufacturer's standard products or (3) low quantities for each order.

6) Purchasing Methods

The shipyard's purchasing department is responsible for acquiring material which satisfies the requirement of the purchase specification at the lowest cost. In current practice, it usually takes several months to issue purchase orders, review and approve vendor furnished information, and release the equipment for manufacture. This, combined with long manufacturing lead times, results in significant delay for engineering and/or production.

Recently, some shipyards have succeeded in solving these problems by entering into basic agreements with the vendors on purchase specifications, etc., prior to contract award, and by purchasing vendor's standard catalogue products. This approach has simplified purchasing procedures, reduced schedule durations and lowered costs of vendor furnished material.

1.1.3 Changes in Ship Types, Ship Operation and Shipbuilding Methods in U.S.

To adapt to advances in technology and economic circumstances, the types of ships, construction methods and ship operation procedures are continually being re-evaluated. In developing shipbuilding standards, it is important to anticipate these changes and incorporate the new concepts in the standards. The following changes are forecast in U.S. shipbuilding and operations:

1) Type of Ship's Propulsion System

Diesel propulsion will become predominant.

2) Ship's Operation

Main and auxiliary propulsion systems will become more sophisticated, requiring advanced engineering developments to ensure safe and reliable performance. Instruction books and operating manuals will have to be written/prepared to ensure clear and comprehensible guidance for system operation.

3) Ship's Production System

Advanced shipbuilding methods and processes, such as Zone-outfitting, accuracy control, computer aided design/production integration, etc., are already being introduced in some of the major shipyards, and this trend is expected to eventually impact all U.S. shipyards.

1.1.4 Shipyards' Suggestions to Solve Recognized Problems (From Standardization Viewpoint)

During the shipyard visits, the following suggestions were offered by the shipyards to solve or alleviate the problems they are now experiencing, and to effectively promote standardization.

1) Consolidation of Standards and Criteria

Currently there are too many standards which are duplicative or contradictory. Consolidation and unification of these standards was suggested to avoid excessive design effort and to reduce production costs. One suggestion was to divide standards into military standards and commercial standards and clearly define their applications.

2) Consolidate and Define Responsibility for Plan Approval

Consolidation and simplification of plan approval procedures was suggested. For example, ABS and the Coast Guard should clearly define respective areas of responsibility to simplify plan approval procedures.

3) Consolidation of Inspection

The inspection function as performed by the

regulatory agencies creates a confusing and difficult situation because of the conflicting and often arbitrary requirements imposed upon the shipbuilder.

Transfer of the inspection function to the classification society (ABS) was suggested because of that agency's continuous involvement in that activity and the recency and relevancy of their surveyors' experience.

4) **Establish QA/QC System**

There is often a wide disparity of quality acceptance level criteria as perceived by the shipbuilder, vendor, owner, and the regulatory agencies, resulting in disagreement as to what constitutes an acceptable product. QA/QC standards should be developed to specifically define a product's physical and operating characteristics, and performance requirements, to serve as a basis for understanding among all the parties involved.

5) **Extend Application of Commercial Standards to Military Ships**

Recognizing that there are situations where commercial and Navy standards can be used for each others' requirements, it was suggested that an effort be made to identify specific areas where Navy and commercial standards can be consolidated, improved, or interchanged.

6) **Unified Numbering System for Standards**

A systematized identification plan for documenting and recording standards is considered necessary in order to facilitate communication among all segments of the shipbuilding industry. Using the existing ASTM standards identification system was suggested.

7) **Vendor/Supplier Support**

Success of the U.S. Shipbuilding Standards Program requires a coordinated effort to foster consensus within the marine industry.

The marine equipment supplier community's support and participation in this enterprise is part of the integrated involvement which is necessary for the program to succeed.

8) **Advanced Approval of Voluntary Commercial Standards by Regulatory Bodies**

It was suggested that the development and implementation of voluntary consensus standards could be instrumental in simplifying design cycle and inspection procedures in cooperation with, and in support of, the classification society and the regulatory agencies. A list of acceptable products similar to the Coast Guard's Qualified Products List (QPL) would result in significant savings in costs and time to the industry. Wherever possible, advance approval of industry standards for general vs. a specific application should be pursued.

9) **Establish Production Working Standards**

The use of standards comprising advanced technology concepts/practices are considered essential for maintaining construction schedule durations and ensuring the quality and integrity of all aspects of the work.

10) **Participation of the U.S. Shipbuilding Industry in Standardization**

All segments comprising the U.S. Shipbuilding Industry must lend their support, participation, and involvement in the standards program.

APPROACH TO STANDARDS APPLICATION IN JAPANESE SHIPBUILDING

1. APPROACH TO STANDARDIZATION

At the end of World War II, the Japanese industries were in chaos due to the destruction and damages sustained by the war. It took a decade or more to restore their strength and revitalize industrial activity. The Japanese shipbuilding industry was one of the first to revive its activity and entered into the international market in the early 1950's. In those days, it was difficult for the Japanese shipyards to compete with their foreign counterparts because of their handicap in quality and technology that resulted from the war. So, the Japanese shipbuilding industry quickly realized the necessity of establishing shipbuilding standards to unify and raise the products' quality and to increase their productivity.

In the late 1940's, under the auspices of the Society of Naval Architects of Japan, the major shipyards jointly formed several committees and working groups to establish voluntary design standards, hull construction standards, outfitting standards, quality standards, etc., as a common basis or criteria for design and production. In parallel, national marine standards were established by the Japanese government in coordination with the Japan Marine Standards Association (JMSA) which represented the shipbuilding and pertinent marine industries needs, and the standards thus established formed part of the Japanese Industrial Standards (JIS), enacted by the Ministry of Transport of Japan. Later on, in addition to these national and voluntary standards of the marine industry, most shipyards established their own supplementary standards in areas which were not covered by the former two categories, mainly, to rationalize engineering and production processes to meet their particular circumstances.

To summarize, standardization in the Japanese shipbuilding industry was developed in three different categories, namely, by

- National standards
- Industry-wide voluntary standards
- Companies' in-house standards

2. MARINE JIS STANDARDS

The Japanese Industrial Standards (JIS) are instituted and enacted by the Japanese Government under the Industrial Standardization Law. JIS cover fundamental standards for all industrial fields, excluding those for agriculture and chemistry, and are classified into 19 categories as shown in Fig. 1. To date, about 7,750 JIS standards have been established including about 520 marine JIS standards, coded with the symbol "JISF".

Marine JIS standards are classified into the following:

- Fittings: covering various mooring fittings, anchors, anchor cables, davits, derricks, hatch covers, manholes, steel doors, round scuttles, windows, ventilators, ladders, life boats and davits, galley equipments, pipe fittings, cargo blocks, navigation equipments, etc.
- Engines and Valves: covering design criteria and material specifications and test codes for various machinery, instruments, valves, strainers, filters, pipe flanges and joints, tools, etc.
- Electric Appliances & Navigational Instruments: covering various electric lamps, lights, projectors, batteries, signal lamps, engine telegraphs, switches, distribution boards, etc.

An Index of existing JIS-F standards is attached as Attachment(1).

Category	Symbol	No. of Standards
Civil engineering & architecture	A	463
Machine Engineering	B	1,079
Electrical Engineering	C	816
Automobile	D	294
Railroad	E	199
Shipbuilding	F	515
Steel and iron	G	305
Non-ferrous material	H	321
Chemical	K	1,815
Textile	L	305
Mining	M	235
Pulp and Paper	P	103
Ceramics	R	218
Daily necessaries	S	221
Medical equipment and safety appliance	T	176
Aircraft	W	71
Fundamental & others (packing, welding, radiation, etc.)	Z	608
Total		7,744

(by March 31, 1979

Fig. 1 CLASSIFICATION & NUMBERS OF JIS STANDARDS

The procedure to establish JIS standards is as follows: (Fig. 2)

○ **Proposal of standard objects:**

The Minister, responsible for the respective industry (e.g., Minister of Transport for the shipbuilding and marine industries), inquires to an entrusted private organization of the industry which consist of persons of learning and experience, and representatives from manufacturers and users, etc., to submit proposals for standard objectives based on long-range and annual-base development plans. In the case of shipbuilding, the Japan Marine Standards Association (JMSA) is entrusted by the MOT to act as this organization.

The entrusted organization works out a proposal to the Minister, which is then passed on to the Japanese Industrial Standards Council (JISC) which is designated under the law to deliberate and decide the objects to be standardized. Under the law, the Minister cannot enact any standards without the acknowledgement of JISC.

JISC consists of a General Assembly, a Standards Council and 29 Divisional Councils classified into specialized fields, and under each Divisional Council, there are a number of Technical Committees. The members of JISC are qualified personnel representing universities, institutes, industry (or suppliers), consumers (or users), and relevant government agents. The Agency of Industrial Science and Technology (AIST), Standards Department, acts as a Secretariat to JISC.

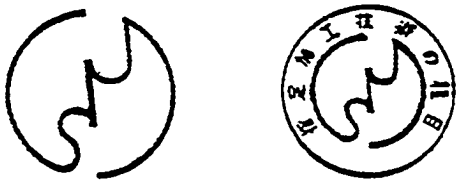
○ **Decision - Enactment - Publication:**

After deliberation by the Divisional Council and respective Technical Committees, and, if deemed necessary, by the Standards Council, JISC then reports their decisions on the proposed standards to the responsible Minister. The standards accepted by JISC are then drafted and documented by AIST (or JMSA for marine standards) for enactment and publication. The enactment of the standard is publicly announced by the responsible Minister through the Japanese government's Official Gazette.

○ **Manufacturing/Marketing of JIS products:**

Any manufacturer who is interested to manufacture and market JIS designated products can apply to the responsible Minister for qualification as a "JIS-licensed factory". Upon receipt of their application, the Minister sends inspectors to the manufacturer to inspect their production facilities, quality control methods, etc., related to the JIS products and, if qualified, will grant the license to the applicant and publicize the JIS product and its manufacturer's name in the Official Gazette.

The manufacturer thus licensed is permitted to bear the "JIS" Mark (Fig. 3) on their designated JIS products. No inspection is required for each JIS product once the license is granted.



3. INDUSTRY-WIDE VOLUNTARY STANDARDS

JIS standards mainly cover items or products that are considered essential for nationwide industries. Standards which need more flexibility in their application are generally entrusted to competent organizations belonging to each industry under their own responsibilities.

In shipbuilding, there are several organizations which have established industry-wide voluntary standards. The organization names, standard codes are as follows:

Organization	Standard Code
— Japan Marine Standards Association (JMSA)	JMS
— Japan Shipbuilders Association (JSA)	ZIS
— The Ship Machinery Manufacturers' Association of Japan (SMMAJ)	SM
— The Society of Naval Architects of Japan (SNAJ)	JSDS JSQS
— The Marine Engineering Society in Japan (MESJ)	MESJ
— Japan Electrical Manufacturers' Association (JEMA)	JEM
— Japan Cable Manufacturers' Association (JCMA)	JCS

○ **JMS Standards**

As mentioned previously, JMSA is a private foundation specially entrusted by the Ministry of Transport for standardization in the shipbuilding

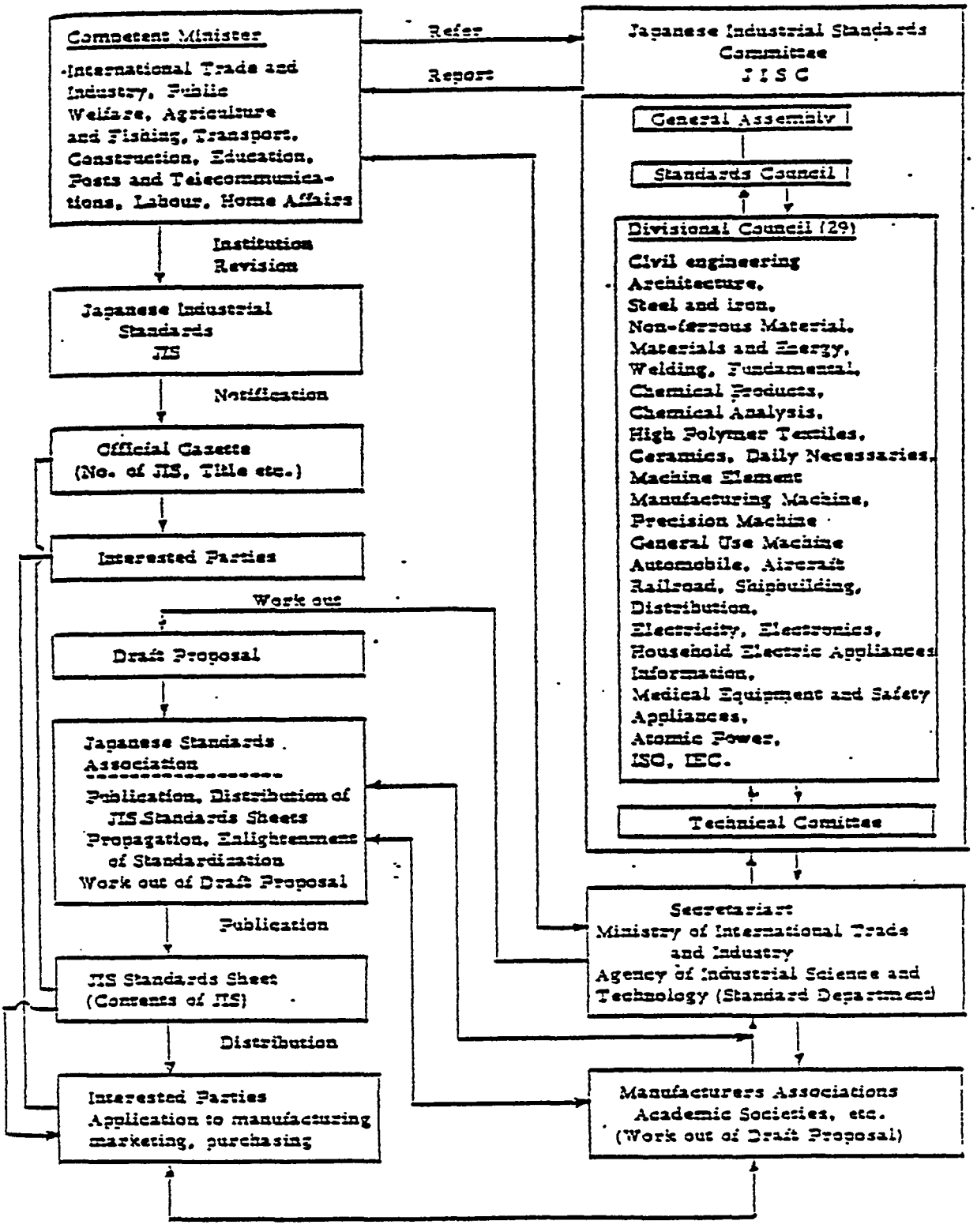


Fig.2 Procedure of Establishing JIS

and marine industries. JMS is distinguished from JIS-F by its objective which covers products or areas that require resiliency in application. More emphasis is placed on "functional" (or performance) standards rather than "product" standards. JMS standards are selected and established by the same members for JISF standards. Therefore, there is no duplication of standards between JISF and JSM.

To date, there are about 140 JMS standards.

O ZIS Standards

ZIS standards are primarily inspection standards for the shipbuilders regarding testing and inspection of machinery and equipment acquired from vendors. Most of these standards are incorporated in shipyards' in-house standards.

O SM Standards

SMMAJ is an organization of ship's machinery and equipment manufacturers consisting of about 300 firms. They have close relationships with the shipbuilders and shipowners who usually act as members of SMMAJ's Technical Committee.

SM standards mainly consist of functional and/or dimensional standards, standard specifications (purchase requirements, purchase orders, production, quality, etc.) for major machinery and equipments. To date, there are about 100 SM standards. Standard purchase orders specifications are used by shipbuilders for purchasing.

O JSDS, JSQS Standards

SNAJ is equivalent to SNAME (but excluding marine engineers) and has acted as a leader in establishing engineering and product quality standards for the shipbuilding industry. Design and engineering standards are coded as JSDS, and product quality standards are coded as JSQS.

JSDS and JSQS are adopted per se or modified and form part of shipyards' in-house standards. To date, there are 23 JSDS standards and/or guidance texts for systems engineering and 10 JSQS standards for welding, hull construction and outfitting quality.

O MESJ Standards

MESJ is the counterpart of SNAJ with membership consisting of mechanical and marine engineers. Similar to SNAJ, MESJ standards are primarily engineering standards for propulsion and auxiliary machinery systems in the engine room, and form part of shipyards' in-house standards. To date, there are 26 MESJ standards.

O JEM Standards

JEMA is an organization of the electrical industry consisting of about 240 firms. JEM standards cover all aspects of electrical machinery and appliances including those for domestic use, supplementary to JIS standards. To date, there are about 120 JEM standards, including 22 for marine equipments.

O JCS Standards

JCMA is an organization for the electric cable manufacturers and JCS standards cover all aspects of electric cables, supplementary to JIS standards.

4. COMPANIES' IN-HOUSE STANDARDS

Although national standards and industry-wide voluntary standards form the basis of the industry's needs, there are still some areas which are not covered by these two categories. Each company naturally has different circumstances, practices and facilities that cannot be dealt with in the same way. Therefore, company in-house standards were established to fill the gaps and/or to suit their particular needs.

Figs. 4 and 5 show in-house standards currently adopted for shipbuilding in IHI.

The standards are basically classified into two main categories, one is the "IS", which are the "Basic Standards", and the other is the "SD", which are the "Standard Drawings".

"IS" include basic standards which must be strictly obeyed by the designers or the workers, and is divided into "Material standards (SO)" and "Engineering standards (SOT)".

Material standards (SO) includes raw material, basic components, fittings and units. Most raw material specifications are specified by national standards or classification society rules, so it is only necessary to standardize sizes or thicknesses, based on manufacturers' standard market products, considering the frequency of usage, shop facilities, storage, etc. Marine JIS components or fittings that are readily available in the market could be used per se as in-house standards. This concept can also be extended to basic machinery or equipments, such as pumps, motors, lifeboats, hatch covers, etc., selected from manufacturer's standard models which are proven to be reliable from past experience. In this case, at least two manufacturers' models of similar characteristics are selected to allow flexibility in purchasing.

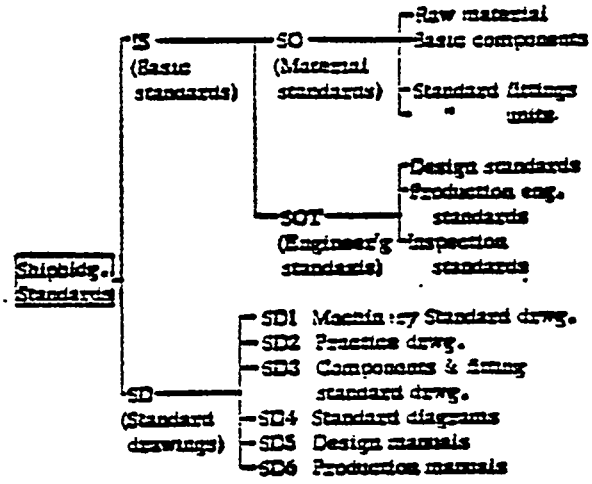


Figure 4. Classification of shipbuilding standards.

Classification of Standards				Nos.
IS	SO	Material standards	Common components	600
			Hull fittings	600
			Machinery fittings	200
			Electric fittings	200
		Sub-total		1,600
	SOT	Design standards		1,100
		Production eng. standards		100
		Inspection standards		200
		Sub-total		1,400
SD		Machinery drawings		1,200
		Component and fitting, standard drawings		350
		Other guidance drawings		350
		Sub-total		1,900
Grand total				4,900

Figure 5. Numbers of standards in current practice.

Engineering standards for design and engineering (SOT) are systematized and categorized into systems and/or production processes. Industry-wide standards, such as JSDS and JSQS are incorporated, either per se or slightly modified, to meet particular requirements. Standard specifications and calculation formulae or sheets are used to unify the design criteria, quality, functions and work practices of the systems.

In addition to the "IS" basic standards, "SD" provide the standard or guidance drawings for machinery and outfitting layouts, basic system modules, manuals and practices, etc., which can be utilized in routine design and production work. Besides the basic modules, "SD" permits some flexibility in application to meet individual requirements.

5. APPLICATION OF STANDARDS

Standards are not only useful as the basis of design, but are also useful as the basis for purchasing, material control, production processes and quality control. In-house standards are especially useful to integrate these functions into a total system, and the introduction of large computers will serve an important role in integrating the overall system.

The following are some typical applications of standards and modules in various stages from design to production.

O Basic Design

At the basic design stage, the work is mostly concentrated on functional design. Therefore, engineering standards, specifically design standards, play the predominant role at this stage.

Standardization of ship construction specifications, hull form characteristics, design criteria of various systems, structural analysis methods, calculation forms, etc., will insure consistency in design philosophy and ship's quality.

Standard modules will also help the designer to decide machinery particulars, system arrangements, piping and wiring diagrams, etc., very rapidly without making serious errors.

Figs. 6 thru 9 show examples of machinery particulars, machinery arrangement and corresponding piping modules of a steam-driven tanker. These standard modules can be used as a base design and, in most cases, only partial modifications are required to meet specific requirements of the ship owner.

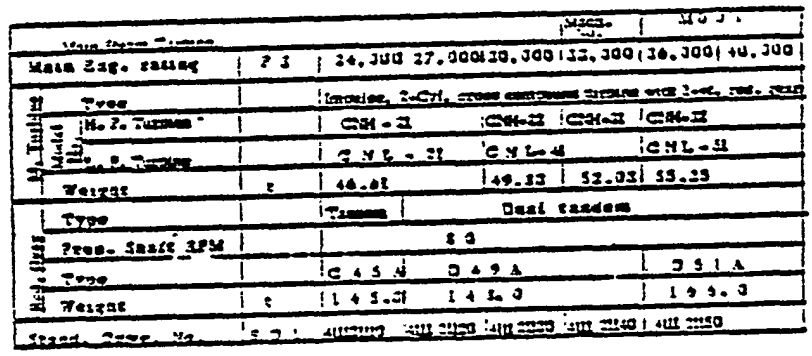


Figure 6. Typical machinery particular module.

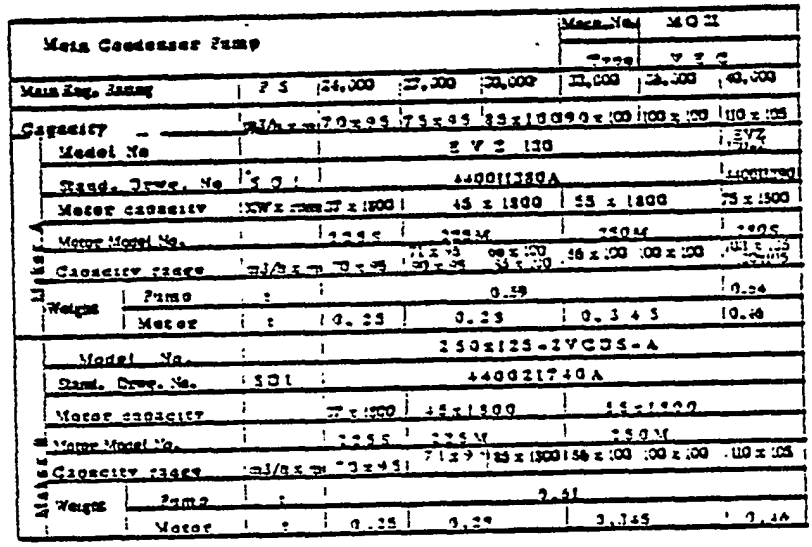
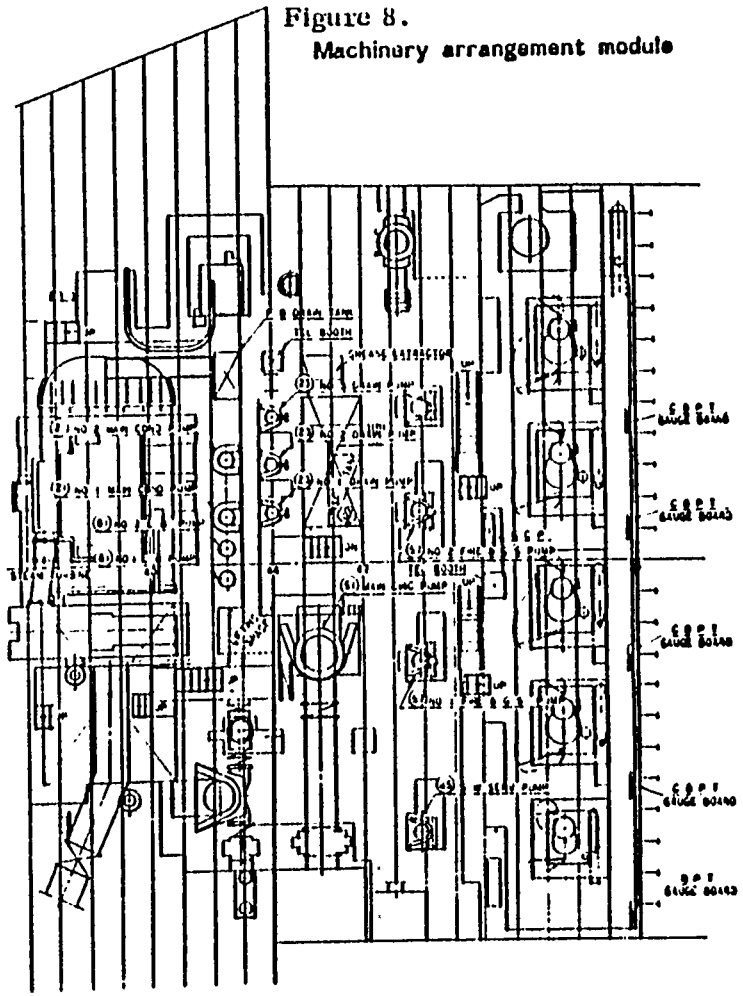


Figure 7. Typical machinery particular module.

Figure 8.
Machinery arrangement module



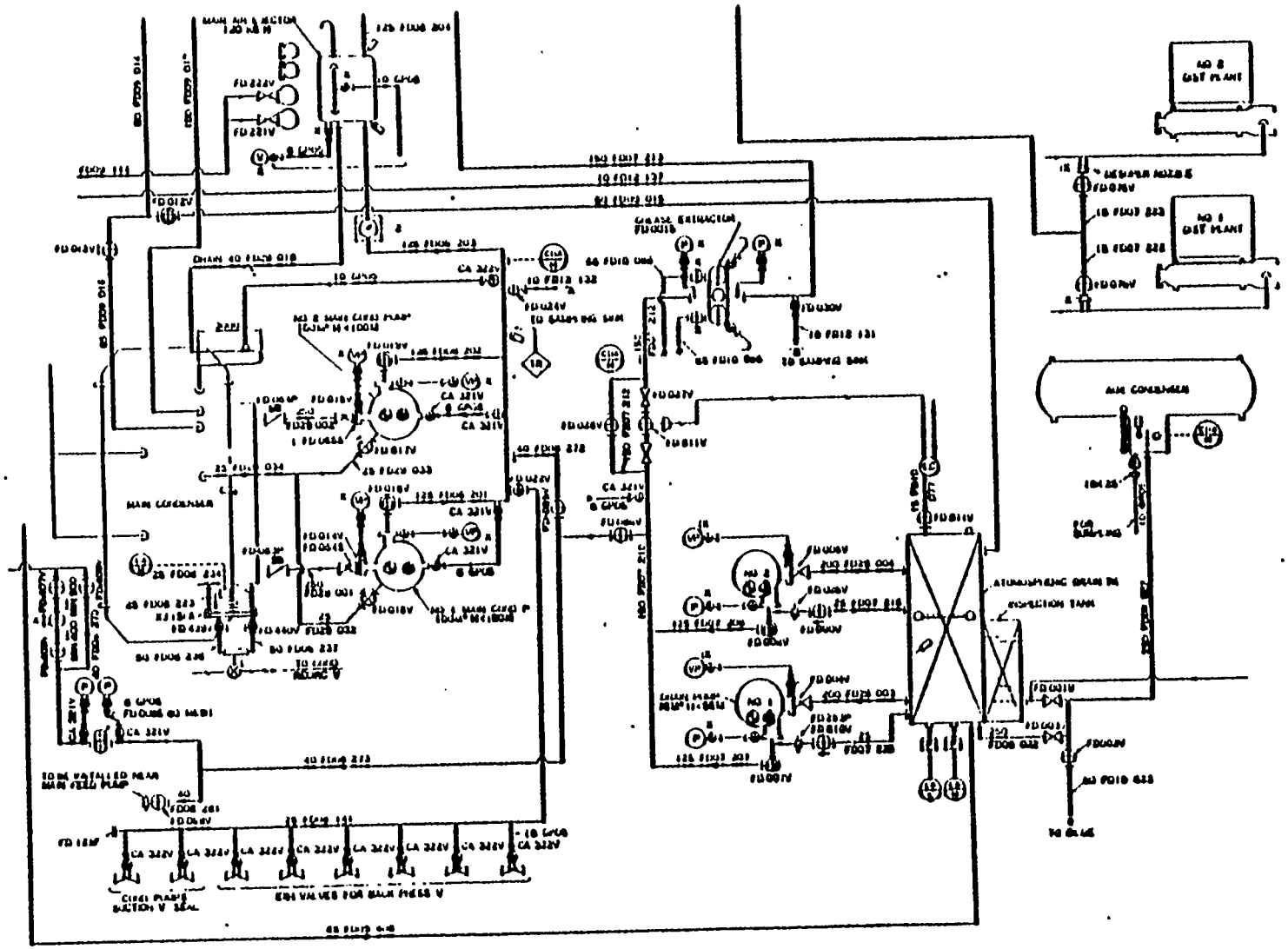


Fig. 9. Piping Layout Module corresponding to Machinery Layout Module Fig. 8.

O Detail Design

In IHI, the major work at the detail design stage is to convert *(or* transition) the system-oriented drawings developed at the basic design stage to zone-oriented drawings to match the zone-production system. Systems are subdivided into zones by composite drawings and workpackages (or pallets) are grouped for each zone. Detailed manufacturing drawings of larger machinery and/or outfitting modules are developed at this stage for on-block outfitting by combining or modifying standards base modules.

Figures 10 and 11 show the diagramatics and the manufacturing drawing of the actual unit module of a drain pump unit module. These units are accompanied with corresponding material lists which include the required material data for the module. Material and components of each unit are supplied to the workshop in pallets end assembled there into a complete package.

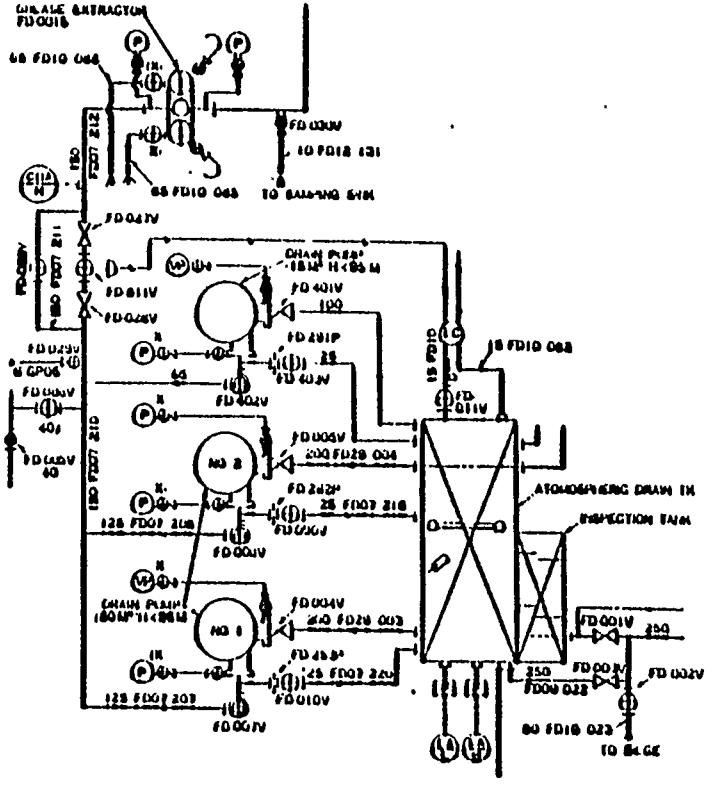


Figure 10. Diagramatics of Drain Pump Unit Module

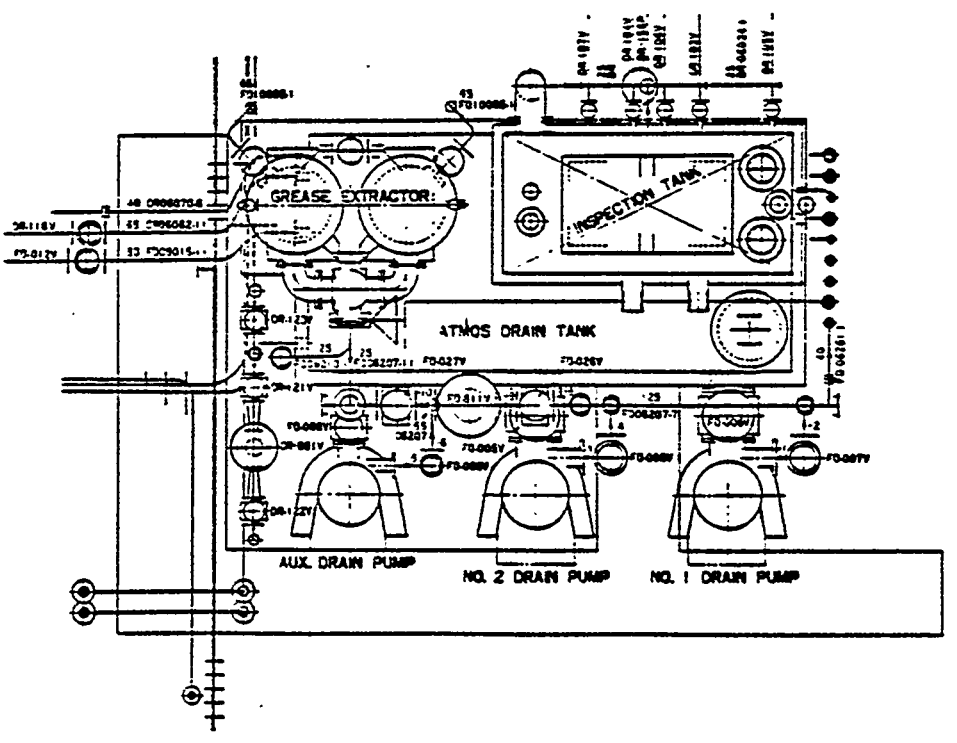


Figure 11. Example of unit equipment (re-Fig. 10)

○ Material Purchasing

Material purchasing is a function that plays an important role in acquiring the required material for the ship's construction and providing it to production at the appropriate time. Purchase orders and pertinent specifications must be prepared and distributed to the subcontractor with proper consideration of the production schedule and the lead time required for manufacturing and delivery of the material. Also, efforts must be paid to minimize stock so that the stockyards or warehouses are not overstocked with redundant material.

Material purchasing is considered as part of the "planning" process, whereas, purchase specifications and manufacturing drawings must be issued by the design department. The issuance of these documents must be precisely scheduled and controlled to support the pallet schedules.

Usually, such work as preparation of purchase specifications, evaluation of vendors' proposals, etc., requires significant time prior to order placement and also requires a great deal of paper work to finalize the contract with the vendors. The time and effort for these functions could be considerably reduced if these materials are preapproved and filed as part of the shipyards' standards.

Consequently, purchase orders can be extremely simplified by issuing a standard purchase order format which simply states the required model number, quantity and delivery date to the vendor.

○ Production

As discussed previously, standardization will enchance productivity by facilitating the introduction of automated fabrication or assembly machinery in the production process. Production scheduling and control could be conducted more precisely and accurately by using statistical records of standard work packages as yardsticks. Standard procedures and/or manuals for welding, pipe fabrication, tolerance, quality assurance, etc., can be used both by designers and workers and they could simplify instructions on individual working drawings.

○ Computerization

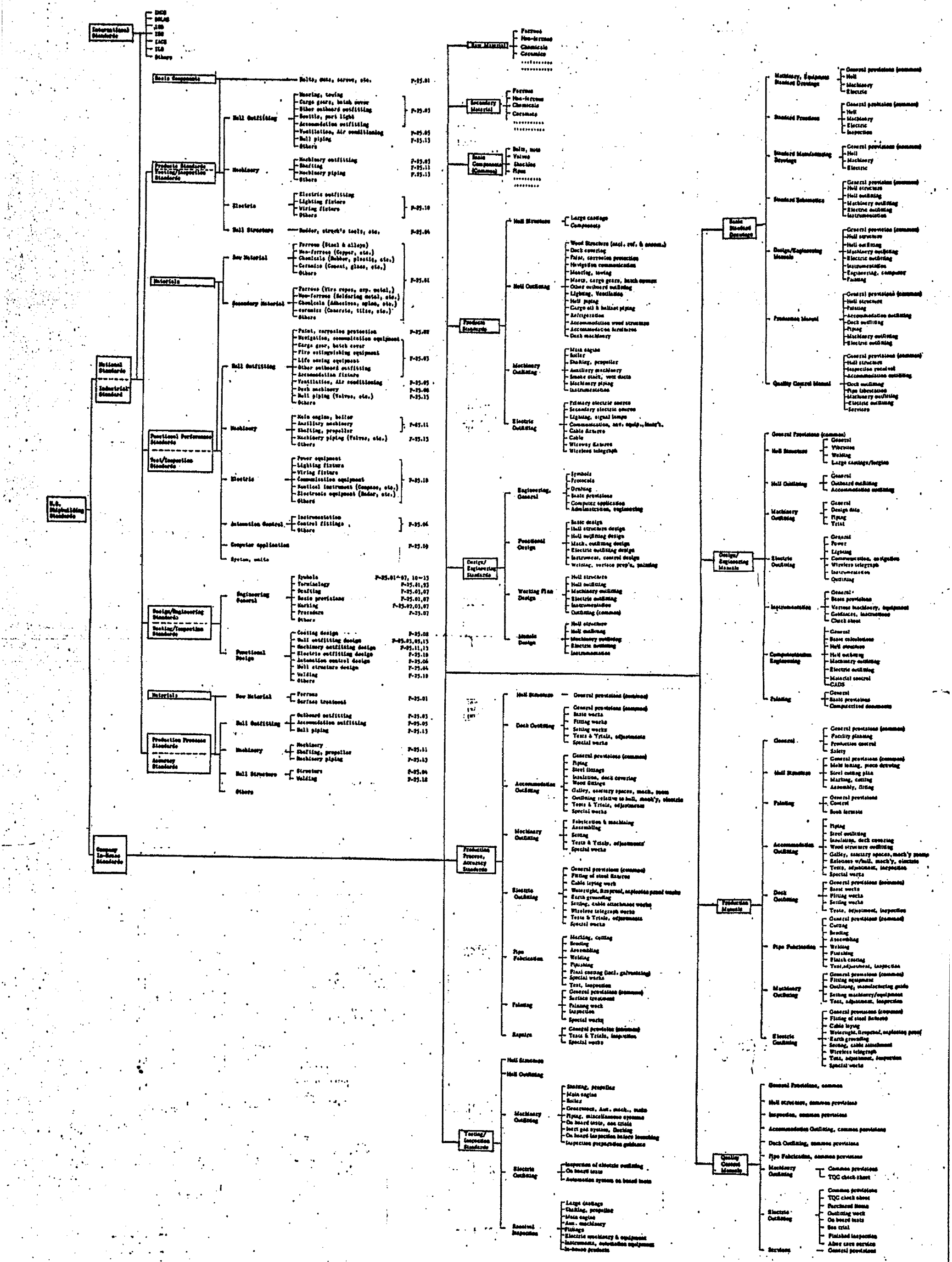
The rapid progress in computer technology has led to wide application of computers for design and production in the shipbuilding industry. Many shipyards are now using computers for design calculations and analyses, NC machines for gas cutting and pipe fabrication, etc. Consequently, shipyards have realized improved productivity and product quality. However, the benefit of computerization cannot be fully realized unless the individual computer processes, from design to production, are interfaced and integrated to form a "total system".

The total system interrelates design, material control, production, scheduling and accounting systems. Without standardization, this massive system cannot be rationally established.

6. ADVANTAGES OF STANDARDIZATION

In conclusion, these three categories of standardization have supplemented each other and have contributed to:

- attaining mutual understanding of the product's performance and quality between the supplier and the user
- simplifying transactions for purchasing
- shortening production by overlapping design/purchasing/production
- raising the technical and/or quality levels of the whole industry
- reducing engineering and production costs by improving productivity
- facilitating planning and control in engineering, purchasing and production
- facilitating computerization


International Standards
ISO
IMO
ISO
IACS
ILO
Others
National Standards
Industrial Standard
U.S. Shipbuilding Standards
Company In-House Standards
Basic Components
Bolts, nuts, screws, etc.
F-25.01
Hull Outfitting
Mooring, towing
Cargo gears, hatch cover
Other outboard outfitting
Bowtie, port light
Accomodation outfitting
Ventilation, Air conditioning
Hull piping
Others
F-25.03
F-25.05
F-25.13
Machinery
Machinery outfitting
Shafting
Machinery piping
Others
F-25.03
F-25.11
F-25.13
Electric
Electric outfitting
Lighting fixture
Wiring fixture
Others
F-25.10
Hull Structure
Rudder, struct'e tools, etc.
F-25.04
Products Standards
Testing/Inspection Standards
Materials
Raw Material
Ferrous (Steel & alloys)
Non-ferrous (Copper, etc.)
Chemicals (Rubber, plastic, etc.)
Ceramics (Cement, glass, etc.)
Others
F-25.01
Secondary Material
Ferrous (Wire ropes, scp. metal,)
Non-ferrous (Soldering metal, etc.)
Chemicals (Adhesives, agnes, etc.)
ceramics (Concrete, tiles, etc.)
Others
Hull Outfitting
Paint, corrosion protection
Navigation, communication equipment
Cargo gear, hatch cover
Fire extinguishing equipment
Life saving equipment
Other outboard outfitting
Accomodation fixture
Ventilation, Air conditioning
Deck machinery
Hull piping (Valves, etc.)
Others
F-25.03
F-25.05
F-25.06
F-25.13
Machinery
Main engine, boiler
Auxiliary machinery
Shafting, propeller
Machinery piping (Valves, etc.)
Others
F-25.11
F-25.13
Electric
Power equipment
Lighting fixture
Wiring fixture
Communication equipment
Nautical instrument (Compass, etc.)
Electronic equipment (Radar, etc.)
Others
F-25.10
Automation Control
Instrumentation
Control fittings
Others
F-25.06
Computer application
F-25.09
System, units
Functional Performance Standards
Test/Inspection Standards
Design/Engineering Standards
Testing/Inspection Standards
Engineering, General
Symbols
Terminology
Drafting
Basic provisions
Marking
Procedure
Others
F-25.01~07, 10~13
F-25.01,03
F-25.01,03
F-25.01,07
F-25.02,03,07
F-25.07
Functional Design
Cooling design
Hull outfitting design
Machinery outfitting design
Electric outfitting design
Automation control design
Hull structure design
Welding
Others
F-25.02
F-25.03,05,13
F-25.11,13
F-25.10
F-25.06
F-25.04
F-25.12
Materials
Raw Material
Ferrous
Surface treatment
F-25.01
Hull Outfitting
Outboard outfitting
Accomodation outfitting
Hull piping
F-25.03
F-25.05
F-25.13
Machinery
Machinery
Shafting, propeller
Machinery piping
F-25.11
F-25.13
Hull Structure
Structure
Welding
F-25.04
F-25.12
Others
Production Process Standards
Accuracy Standards
Products Standards
Raw Material
Ferrous
Non-ferrous
Chemicals
Ceramics
Secondary Material
Ferrous
Non-ferrous
Chemicals
Ceramics
Basic Components (Common)
Bolts, nuts
Valves
Shackles
Pipes
Hull Structure
Large castings
Components
Hull Outfitting
Wood Structure (excl. ref. & accom.)
Deck covering
Paint, corrosion protection
Navigation communication
Mooring, towing
Masts, cargo gears, hatch openings
Other outboard outfitting
Lighting, Ventilating
Hull piping
Cargo oil & ballast piping
Refrigeration
Accommodation wood structure
Accommodation furniture
Deck machinery
Machinery Outfitting
Main engine
Boiler
Shafting, propeller
Auxiliary machinery
Smoke stack, vent ducts
Machinery piping
Instrumentation
Electric Outfitting
Primary electric source
Secondary electric source
Lighting, signal lamps
Communication, nav. equip., instr's.
Cable fixture
Cable
Wireway fixture
Wireless telegraph
Design/Engineering Standards
Engineering, General
Symbols
Protocols
Drafting
Basic provisions
Computer application
Administration, engineering
Functional Design
Basic design
Hull structure design
Hull outfitting design
Mach. outfitting design
Electric outfitting design
Instrument, control design
Welding, surface prep'n, painting
Working Plan Design
Hull structure
Hull outfitting
Machinery outfitting
Electric outfitting
Instrumentation
Outfitting (common)
Manuals Design
Hull structure
Hull outfitting
Machinery outfitting
Electric outfitting
Instrumentation
Production Process, Accuracy Standards
Hull Structure
General provisions (common)
Deck Outfitting
General provisions (common)
Basic works
Fitting works
Setting works
Tests & Trials, adjustments
Special works
Accommodation Outfitting
General provisions (common)
Piping
Steel linings
Insulation, deck covering
Wood linings
Galley, sanitary spaces, mach. room
Outfitting relative to hull, mach'y, electric
Tests & Trials, adjustments
Special works
Machinery Outfitting
Fabrication & machining
Assembling
Setting
Tests & Trials, adjustments
Special works
Electric Outfitting
General provisions (common)
Fitting of steel fixtures
Cable laying work
Watertight, fireproof, explosion proof couplings
Earth grounding
Setting, cable attachment works
Wireless telegraph works
Tests & Trials, adjustments
Special works
Pipe Fabrication
Marking, cutting
Bending
Assembling
Welding
Pipefitting
Final coating (incl. galvanizing)
Special works
Test, inspection
Painting
General provisions (common)
Surface treatment
Painting work
Inspection
Special works
Repairs
General provisions (common)
Tests & Trials, inspection
Special works
Testing/Inspection Standards
Hull Structure
Hull Outfitting
Machinery Outfitting
Shafting, propeller
Main engine
Boiler
Governors, Aut. mach., units
Piping, miscellaneous systems
On board tests, sea trials
Inert gas system, flushing
On board inspection before launching
Inspection preparation guidance
Electric Outfitting
Inspection of electric outfitting
On board tests
Automation system on board tests
Material Inspection
Large castings
Shafting, propeller
Main engine
Aux. machinery
Fittings
Electric machinery & equipment
Instruments, automation equipment
In-house products
Design/Engineering Manuals
Basic Standard Drawings
Machinery, Equipment Standard Drawings
General provisions (common)
Hull
Machinery
Electric
Standard Practices
General provisions (common)
Hull
Machinery
Electric
Inspection
Standard Manufacturing Drawings
General provisions (common)
Hull
Machinery
Electric
Standard Schematics
General provisions (common)
Hull structure
Hull outfitting
Machinery outfitting
Electric outfitting
Instrumentation
Design/Engineering Manuals
General provisions (common)
Hull structure
Hull outfitting
Machinery outfitting
Electric outfitting
Instrumentation
Engineering, computer
Planning
Production Manual
General provisions (common)
Hull structure
Painting
Accommodation outfitting
Deck outfitting
Piping
Machinery outfitting
Electric outfitting
Quality Control Manual
General provisions (common)
Hull structure
Inspection standard
Accommodation outfitting
Deck outfitting
Pipe fabrication
Machinery outfitting
Electric outfitting
Services
Design/Engineering Manuals
General Provisions (common)
Hull Structure
General
Vibration
Welding
Large castings/forgings
Hull Outfitting
General
Outboard outfitting
Accommodation outfitting
Machinery Outfitting
General
Design data
Piping
Trial
Electric Outfitting
General
Power
Lighting
Communication, navigation
Wireless telegraph
Instrumentation
Outfitting
Instrumentation
General
Basic provisions
Various machinery, equipment
Guidance, instructions
Check sheet
Computerization Engineering
General
Basic calculations
Hull structure
Hull outfitting
Machinery outfitting
Electric outfitting
Material control
CADS
Painting
General
Basic provisions
Computerized documents
Production Manuals
General
General provisions (common)
Facility planning
Production control
Safety
Hull Structure
General provisions (common)
Mold loftings, piece drawing
Steel cutting plan
Marking, cutting
Assembly, lifting
Painting
General provisions
Control
Book formats
Accommodation Outfitting
Piping
Steel outfitting
Insulation, deck covering
Wood structure outfitting
Galley, sanitary spaces, mach'y rooms
Relations w/hull, mach'y, elec'nics
Tests, adjustment, inspection
Special works
Deck Outfitting
General provisions (common)
Basic works
Fitting works
Setting works
Tests, adjustment, inspection
Pipe Fabrication
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8002-76	General Rules on the Temperature Test of Electric Lighting Fittings (Incandescent Lamps) for Marine Use
8003-75	General Requirements for Construction of Electric Lighting Fittings (Incandescent Lamps) for Marine Use
8004-79	General Requirements for Construction and Inspection of Electrical Flameproof Apparatus for Marine Use
8006-79	General Requirements for Vibration Test of Electrical Apparatus for Marine Use
8007-79	General Requirements for Degree Protection and Inspection of Enclosures for Marine Electrical Apparatus
8011-80	Graphical Symbols for Electrical Power Apparatus for Marine Engineering Drawings
8012-80	Graphical Symbols for Electrical Lighting Fittings and Accessories for Marine Engineering Drawings
8013-80	Graphical Symbols for Electrical Communication Apparatus for Marine Engineering Drawings
8101-76	Lead-acid Marine Batteris
8401-78	Lamp Holders for Marine Use
8402-78	Glass Gloves for Marine Electric Lights
8403-77	Front Glasses for Marine Electric Lights
8404-63	Glass Globes for Marine Indicator Lamps
8405-77	Lenses for Marine Morse Signal Lamps
8407-76	Marine Lamps
8410-79	Recessed Type Ceiling Lights for Marine Use (Non-watertight Type)
8411-79	Ceiling Lights for Marine Use (Non-watertight Type)
8412-79	Cargo Lights
8413-79	Boat Deck Lights
8414-78	Pendant Lights for Marine Use
8415-79	Watertight Type Hand Lamps for Marine Use
8416-76	Watertight Type Wall Lights for Marine Use
8417-78	Floodlighting Projectors for Marine Use
8420-76	Berth Lights for Marine Use
8421-78	Chart Table Lights
8422-79	Flameproof Ceiling Lights for Marine Use

STANDARD NO. (JIS F)	TITLE
ⓒ 8423-79	Flameproof Bulkhead Lights for Marine Use
ⓒ 8425-78	Flameproof Portable Electric Lamps for Marine Use (Dry Cells and Batteries Type)
ⓒ 8427-76	Hand Lamps for Marine Use (Non-watertight Type)
ⓒ 8428-77	Portable Lamps (Simple Type) for Marine Use
ⓒ 8429-77	Pendant Lights (Simple Type) for Marine Use
ⓒ 8430-77	Cargo Lights (Simple Type)
ⓒ 8431-79	Ballasts for Fluorescent Lamp for Marine Use
ⓒ 8434-75	Fluorescent Table Lamps for Marine Use
ⓒ 8435-75	Fluorescent Wall Lights for Marine Use (Non-watertight Type)
ⓒ 8436-64	Fluorescent Ceiling Lights for Marine Use (Non-watertight Type)
ⓒ 8437-64	Fluorescent Ceiling Lights for Marine Use (Watertight Type)
8438-77	Fluorescent Berth Lights with Spare Light for Marine Use
ⓒ 8441-75	Watertight Type Passage Lights for Marine Use
8442-79	Special Type Cargo Lights
8443-79	Reflector Lamp Type Flood Lights for Marine Use
8444-79	High Pressure Mercury Vapour Lamp Type Flood Lights for Marine Use
8445-79	Halogen Lamp Type Flood Lights for Marine Use
ⓒ 8450-77	Morse Signal Lamps for Marine Use
ⓒ 8451-77	Keys for Morse Signal Lamps for Marine Use
ⓒ 8452-74	Navigation Light Indicators
ⓒ 8453-77	Call Bell Indicators for Marine Use
8455-78	Daylight Signalling Lamps for Marine Use
8456-75	Portable Daylight Signalling Lamps for Marine Use
ⓒ 8457-78	Signalling Lights for Marine Use
8458-77	Navigation Light Indicators (Simple Type)
ⓒ 8459-79	Searchlights for Marine Use
ⓒ 8501-80	Watertight Type Electric Bells for Marine Use
ⓒ 8502-78	Electric Buzzers for Marine Use
ⓒ 8503-75	Push Buttons for Marine Use
8504-74	Electronic Horns for Marine Use
8505-79	Small Motor Sirens for Marine Use
ⓒ 8521-79	Electric Propeller Shaft Revolution Indicators for Marine Use
ⓒ 8522-78	Electric Rudder Angle Indicators
ⓒ 8523-79	Electric Engine Telegraphs for Marine Use
8524-79	Small Size Electric Engine Telegraphs
8601-76	General Rules of Radio Telegraph for Ships
8602-76	Testing Methods of Radio Telegraph for Ships

STANDARD NO. (JIS F)	TITLE
8801-79	Marine Watertight Cable Glands for Electric Appliances
8802-74	Marine Cable Glands for Bulkhead and Deck
8804-76	Electric Cable Clips for Marine Use
8805-63	Electric Cable Hangers and Saddles for Marine Use
8806-76	Protective Rubber-like Sheaths of Portable Cord for Marine Use
8811-79	Small Size Terminals for Marine Use
8812-79	Terminal-Boards for Marine Use
8813-79	Crimp Terminal Boards for Marine Use
8821-78	Watertight Type Joint Boxes for Marine Use
8822-77	Joint Boxes for Marine Use (Non-watertight Type)
8823-77	Distribution Boards (Fuse Type) for Marine Use
8824-77	Section Boards (Fuse Type) for Marine Use
8825-77	Shore Connection Boxes for Marine Use
8826-75	Simple Type Distribution Boards for Marine Use
8827-75	Simple Type Section Boards for Marine Use
8828-77	Distribution Boards with Circuit Breakers for Marine Use
8829-80	Section Boards with Circuit Breakers for Marine Use
8830-77	Shore Connection Boxes (Small Type) for Marine Use
8831-75	Non-watertight Type Plugs for Marine Use
8832-79	Watertight Type Plugs for Marine Use
8833-79	Watertight Type Receptacles for Marine Use
8835-75	Non-watertight Type Receptacles for Marine Use
8836-78	Watertight Type Plugs and Socket-outlets for Marine Use
8840-75	Non-watertight Type Snap Switches for Marine Use
8841-77	Watertight Type Small Switches for Marine Use
8843-77	Small Toggle Switches for Marine Use
8844-75	Unit Switches for Marine Use
8845-77	Rotary Switches for Marine Use
8846-77	Control Switches for Marine Flameproof Light
8851-77	Dimmers for Marine Lamps
8852-78	Dimmers for Marine Instrument Illumination
9101-75	Magnetic Compasses for Marine Use
9701-78	Pressure Switches for Marine Use

SHIP PRODUCIBILITY RESEARCH PROGRAM
TASK S-29

RECOMMENDED
U.S. SHIPBUILDING STANDARDS PROGRAM

LONG-RANGE PLAN

VOLUME II

RECOMMENDENDED U. S. SHIPBUILDING STANDARDS

LONG-RANGE PIAN

IHI MARINE TECHNOLOGY, INC .
ISHIKAWAJIMA—HARIMAHEAVY INDUSTRIES CO., LTD.

VOLUME II — RECOMMENDED U.S. SHIPBUILDING STANDARDS LONG-RANGE PLAN

CONTENTS

U.S. SHIPBUILDING STANDARDS PROGRAM
LONG-RANGE PLAN

VOLUME II - RECOMMENDED
U.S. SHIPBUILDING STANDARDS
LONG-RANGE PLAN

2.1 **INTRODUCTION**

The background *rationale* and guidelines for standization in shipbuilding have been delineated in Volume I.Based upon these considerations, practical suggestions for establishing a long-range standards development plan for the U.S. Shipbuildings Standards are includeded in Volume I I

2.2 APPROACH

Based upon the logic and basic considerations described in Volume I, the recommended standards long-range plan for the U.S. shipbuilding industry has been developed and compiled in this Volume.

The basic "tree structure" adopted for the development of the long-range plan is attached as APPENDIX II-A This "tree structure" shows the correlation between the standards categories and the standards items grouped by families. Also, Cross-reference is made to ASTM F-25 Technical Subcommittees which are anticipated to act as primary working groups for the development and implementation of national standards and industry voluntary standards.

The list standard items, ,grouped in families and classified by priority *order (i.e., short-term*, mid-term, long-term goals), are consolidated and compiled in APPENDIX II-B.

In general, the selection of standard items and assignment of priorities reflect the standardization approach and experience of the Japanese shipbuilding industry, which is described in APPENDIX I-B.

Standards listed *cover* moat of the items which have been standardized in Japan, either as national, industry or in-house standards. The logic behind categorization of national, industry and in-house standards, and the rationale for assigning priorities for development, are derailed in Volume L

2.3 IMPLEMENTATION OF THE LONG-RANGE PLAN

The recommended standards long-range plan presented in this volume is considered to be alogical and practical approach for the U.S. shipbuilding industry. These who will play a part in the implementation of the recommended plan must recognize, and communicate to other that its effective prosecution will **represent a** task of significant magnitude, of long duration and National scope. The potential benefit to the industry as a whole, and to the individual participants, are substantial to say the least. Implementation of a major National initiative to pursue the standardization objectives outlined in the recommended long-range plan should be viewed as an essential element of any program to improve productivity and revitalize the U.S. Sbipbuilding industry.

Accordingly, as the first step toward implementation of the standards long-range plan, it is recommended that the shipbuilding industry, through the Society of Naval Architects and Marine Engineers (SNAME), directly contact top level officials in the principal government agencies and private organizations involved (e.g. MarAd, U.S. Navy, USCG, ABS, etc.) to solicit their support. With such top level committment, immediate steps should be taken (perhaps through a high level steering committee) to finalize the long-range Plan to resolve organizational structure and support, and to publicize program implementation as a major, cooperative National effort.

It is important to recognize that if the recommended standards long-range plan is not implemented with the appropriate level of support and participation, particularly on the part of key organizations, that the attainment of shipbuilding standardization goals will be difficult to impossible.

To expedite standardization benefits simulta neous and coordinated efforts must be initiated to consolidate existing requirements and to develo standards at the National industry and compan levels in accordance with the priorities listed.

2.4 RECOMMENDED ORGANIZATIONAL STRUCTURE

It has been observed that organizational structures for shipbuilding standards development in the U.S. are similar to those employed in Japan. For instance, government *agencies* and private organizations, similar to the Japanese counterparts, exist

as follows:

1) Government agencies:
   Maritime Administration
   U.S. Navy
   U.S. Coast Guard
2) Classification Society:
   ABS
3) Private organizations:
   ANSI, ASTM, SNAME, etc.

In addition to the above, other participants required for establishment of shipbuilding standards include shipbuilders, design agents, shipowners/operators, and suppliers/vendors from supporting industries.

Accordingly, the following are recommended organizational structures and responsible organizations for the development and implementation of U.S. national standards and industry voluntary standards:

INSERT National Standards and Industry Voluntary Standards

The following sections summarize the participation and/or responsibilities of the organizations concerned:

1) **Maritime Administration**
   a) Support standardization long-range plan for national commercial shipbuilding standards.
   b) Authorize and approve national standards.
   c) Registration and publication of national standards.
   d) Refer printing and distribution of national standards to ANSI or ASTM.
   e) Coordinate consolidation of commercial/military standards with U.S. Navy.
   f) Sponsor funding of shipbuilding standards development. (National and industry levels)

2) **U.S. Navy**
   a) Support standardization long-range plans for military requirements.
   b) Develop, authorize, enact, publicize and distribute military standards.
   c) Assist MarAd to consolidate commercial/military standards, (excluding combat systems) and encourage application of commercial standards in navy ships.
   d) Participate as committee member for deliberation of commercial/industry standards.
   e) Sponsor funding of shipbuilding standards development. (National and industry levels)

3) **U.S. Coast Guard**
   a) Support standardization long-range plans for shipbuilding.
   b) Review and approval of shipbuilding standards for compliance with international (SOLAS, MARPOL, IMCO, etc.) or Federal rules and regulations.
   c) Participate as committee member for deliberation of commercial standards and provide guidance from Federal regulations viewpoint.
   d) Require or permit application of national/industry standards through Federal regulations.

4) **American Bureau of Shipping**
   a) Support standardization long-range plans for shipbuilding.
   b) Participate as committee member for deliberation of commercial standards and provide guidance from the classification rules viewpoint.
   c) Require or permit application of national/industry standards through classification rules.

5) **ASTM**
   a) For national standards, function on behalf of MarAd or others for development of standards.
   b) For industry voluntary standards, authorize, publish and promote standards.
   c) Publicize and distribute national/industry standards.

6) **ASTM F-25**
   a) Maintain administrative and technical committees to develop and approve standards drafts.
   b) Development and prosecution of standards long-range plan.
   c) Act as coordinator or solicitor to regulatory bodies or other relevant organizations for review of standard drafts.

7) **SNAME**
   a) Function as an advisory committee and/or steering committee for the industry to establish U.S. shipbuilding standards long-range plans, for national and industry voluntary standards.
   b) Provide recommendations to ASTM F-25 for development of long-range plans and deter-

mination of priorities for standards development.

c) Promote standardization and encourage standards application within the industry.

8) **Shipyards, Design Agents**

a) Participate as committee members for the review and approval of standards, and provide input from the shipbuilders' viewpoint.

b) Participate as members of the task group for development of standards drafts, and provide necessary technical data and information.

c) Initiate and promote the use of standards.

9) **Suppliers/Vendors**

a) Participate as committee members for the review and approval of standards, and provide input from the manufacturers' viewpoint.

b) Participate as members of the task group for development of standards drafts, and provide necessary technical data and information.

c) Initiate and promote the use of standards.

10) **Shipowners/Operators**

a) Participate as committee members for the review and approval of commercial standards, and provide input from the users' viewpoint.

b) Support development and application of standards.

11) ANSI

a) Coordination, development and management of national standards and international standards.

b) Participate in the review and approval of national standards drafts developed by ASTM or others.

For the most part, the existing organizational structure for the National Shipbuilding Standards Program involving the Maritime Administration, SNAME Panel SP-6, ASTM Committee F-25, the U.S. Navy and member shipyards of SNAME SP-6, will form the basic structure for the development of national standards and industry voluntary standards, with further participation of regulatory bodies and related industries, shipowners, etc., as indicated previously.

Again, implementation of the standards long-range plan for national/industry standards will require the top level support of all organizations involved. As a prerequisite to initiating this work, it is recommended that senior officials in each of the involved organizations be briefed on the plan and requested to provide their support for the program.

The organizational structure for individual in-house standards varies depending on the scope of standardization intended, and the size of the shipyard. If the shipyard intends to promote standardization at a significant level, it is essential to establish a special project team under the direct control of top management to execute the work. Long-range plans should be established by top management based upon a survey of the shipyard's needs. Standards drafts should be deliberated by key personnel from engineering, production and other areas concerned, and standards thus established should be registered as company standards and distributed for use in the shipyard.

Figure 2-1 Organization of Standards Committee

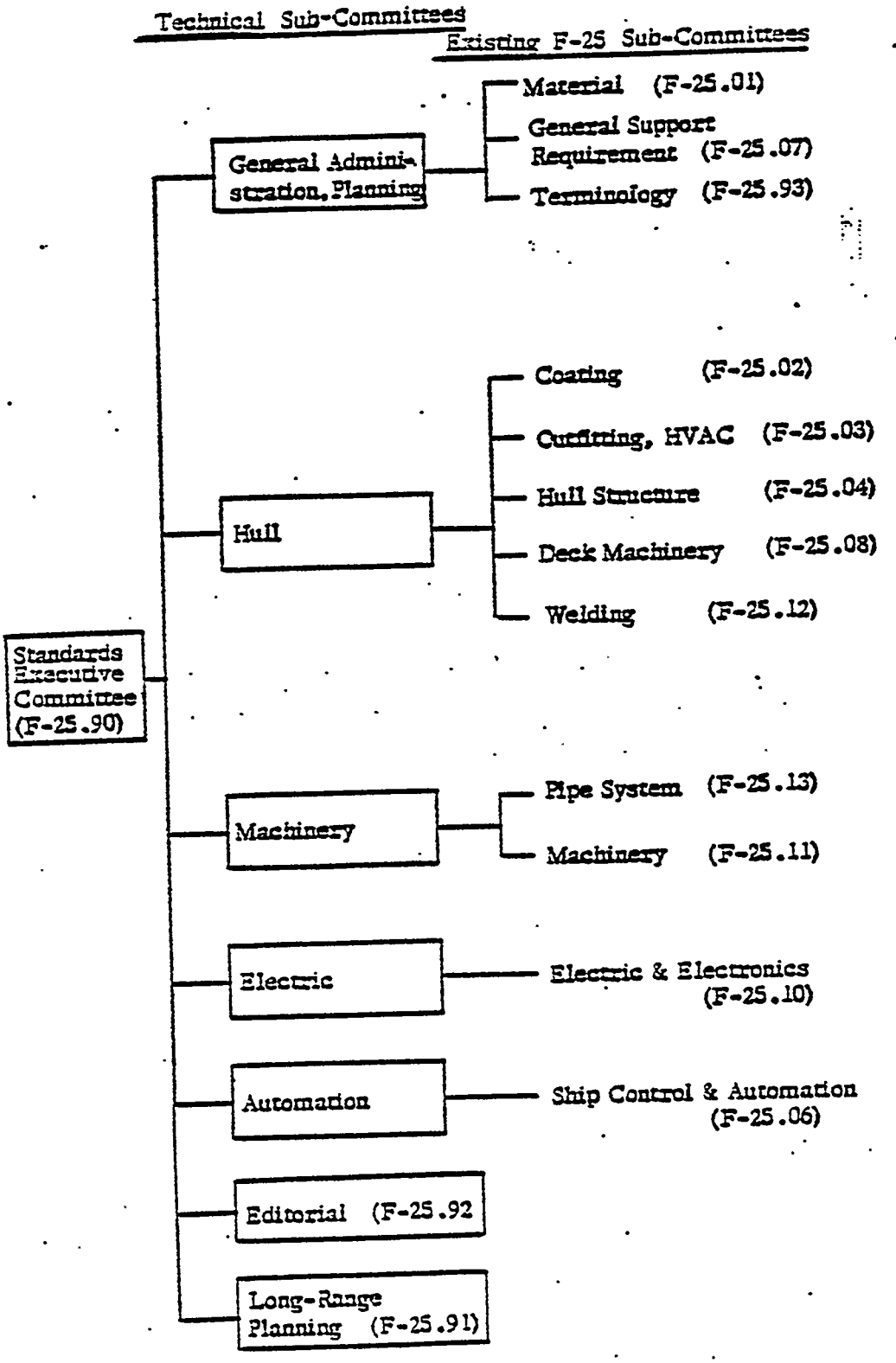
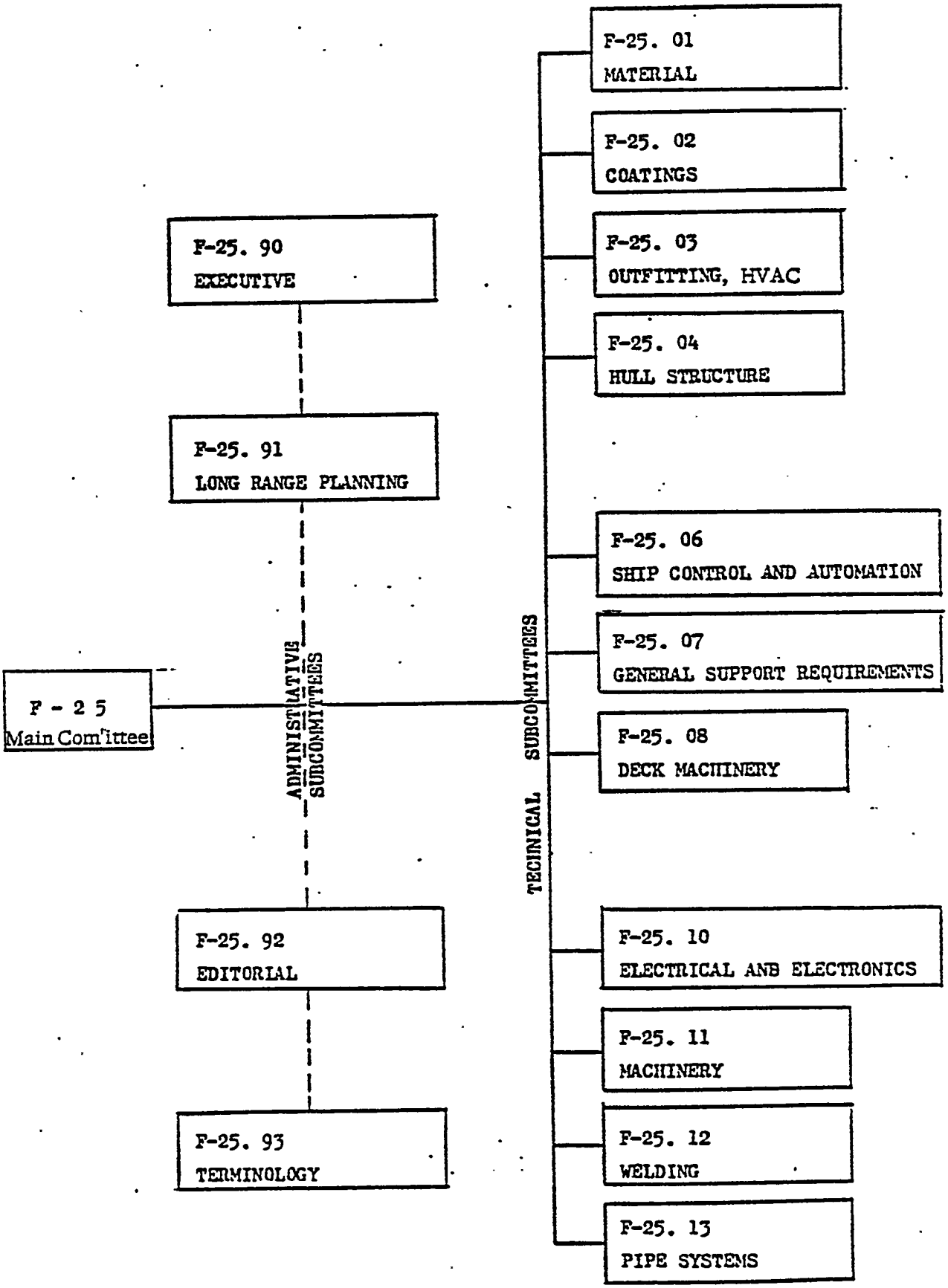


Figure 2-2 ASTM COMMITEE F-25 ORGANIZATION



2.5 DETAILED PLANNING GUIDELINES

2.5.1 Detail Planning

As discussed previously, the establishment of a long-range plan is a prerequisite and the key for standards development. Therefore, detailed elements of the long-range plan should be planned and assessed carefully based upon a pre-determined process and evaluation format considering the factors as outlined in Section 1.5 of Volume I. By following this assessment process, standards priorities can be selected accurately without being affected by the changes in external circumstances.

1) **Process of Establishing a Detailed Standards Plan**

The recommended process of establishing a detailed (e.g. annual) plan and the factors to be assessed are as follows:

a) Review recommended U.S. shipbuilding standards long-range plan.
b) Draft a more detailed and specific plan based upon the general policy and goals.
c) Conduct survey to obtain comments and recommendations on the detailed plan draft from all parties concerned (by questionnaire).
d) Determine items to be standardized, and evaluate priorities.
e) Compile evaluation results of standards items.
f) Finalize detailed standards plan.

2) **Work Flow and Allotment of Work**

A sample work flow for developing a detailed standards plan for national standards/industry voluntary standards is shown in Figure 2-3.

2.5.2 Evaluation of Standards Items

At the initial stage of standardization, there is difficulty in selecting appropriate items or prioritizing their development due to the extensive scope of work. Therefore, there should be an appropriate criterion, regardless of the type of standards, to properly evaluate and select candidate items and determine priorities. The following are the judgment factors used by JIS for evaluating the selection or priority of standards.

1) Selection of Standards Items

Usually, as the first step, requests and suggestions for the development of new standards are collected from shipbuilders, shipowners, suppliers, vendors, regulatory bodies, etc., to obtain an overall view of the industry needs, and inputs thus collected are evaluated considering their influence and benefits to the industry.

The items which are selected for standardization are prioritized by evaluating their economic impact and contribution to the marine community or industry. The evaluation system (point system) used by JIS is shown in Figure 2-4 for reference.

The selection is evaluated from two different aspects, one from a comprehensive viewpoint and the other by evaluation of individual factors.

Figure 2-3 Sample Work Flow for Developing a Detailed Standards Plan

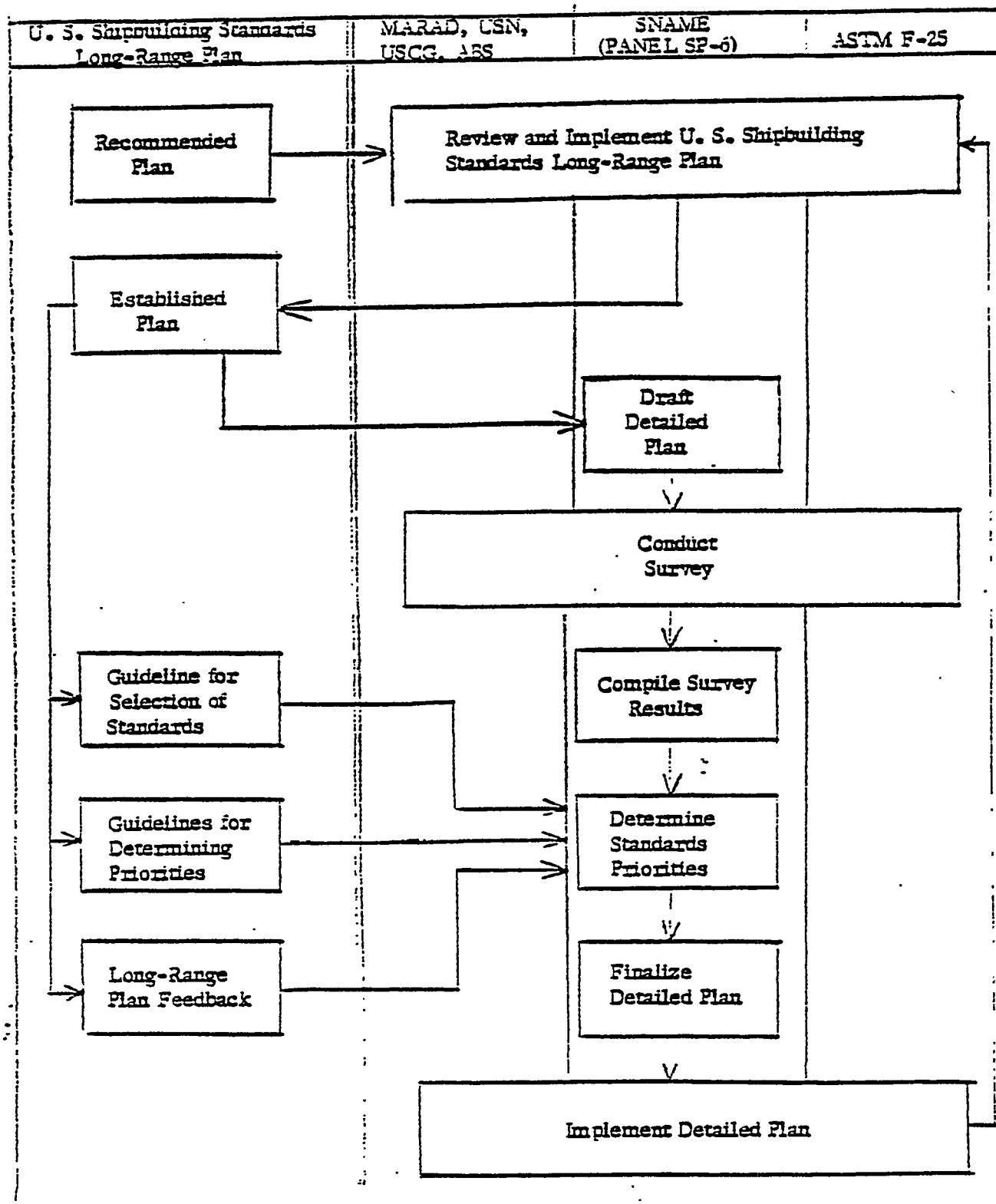
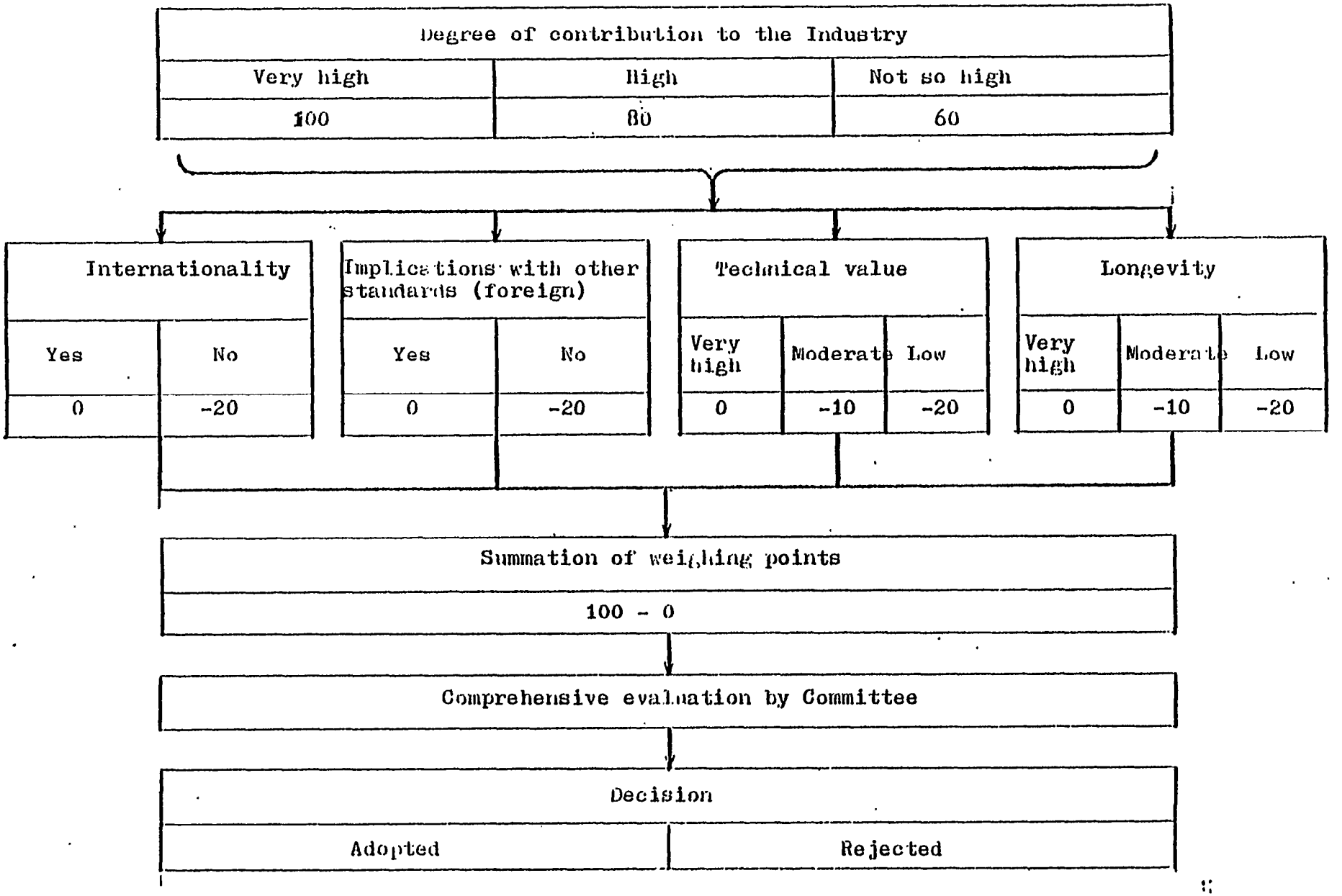


Figure 2-4 Evaluation of Standards Candidates (JIS)



A) Comprehensive Evaluation

The selection for standardization is judged based on the projected contribution to the maritime, shipbuilding and pertinent industries, focusing on:

- Improvement in quality
- simplification and improvement of production and engineering procedures
- Improvement in productivity
- simplification of procurement and other transactions, etc.

B) Evaluation by Individual Factors

The following are the individual factors which are usually used for evaluation:

a) Internationality:

Evaluate the item's merit based on the implications of international standards (ISO, IEC) and international rules and regulations (SOLAS, MARPOL, IMCO, etc.)

b) Evaluation vs. other foreign national standards:

Evaluate the necessity and the merits and demerits of standardizing the item in comparison with the trends of other foreign national standards.

c) Technical value:

Evaluate whether the standardized product is technically superior to other analogous products, and whether the standardization of the product is feasible and effective for the industry.

d) Longevity of the standard:

Evaluate its longevity considering the impact of technological progress and changes in the market place.

2) Assessment of Priorities

The priority of standards should be determined through assessment based upon a common scale and, needless to say, by its contribution to the total standardization program. Similar to the selection of standards items, the assessment is usually made in two different ways, one from a comprehensive viewpoint, and the other by evaluation of individual factors. The evaluation system (point system) used by JIS is shown in Figure 2-5 for reference.

C) Comprehensive Assessment

Timing of the development is evaluated by its urgency considering:

a) demands and trends of the international and/or domestic marine and shipbuilding industries.

b) impact on productivity and other shipbuilding technology.

c) Advance in technology:

Evaluate its impact on the implementation of advanced technologies.

D) Assessment by Individual Factors

a) Evaluation relative to international rules and regulations:

Evaluate urgency, considering the timing to meet new requirements of international rules and regulations.

b) Evaluation vs. other foreign national standards:

Consider the enactment (or revision) date of similar foreign national standards.

3) Determination of Standards Items and Priorities

After evaluating selection and priorities, the results are compiled in a summary table, similar to the example shown in Figure 2-6, and final decisions are made by the Standards Committee.

Figure 2-5 Evaluation of Priorities (JIS)

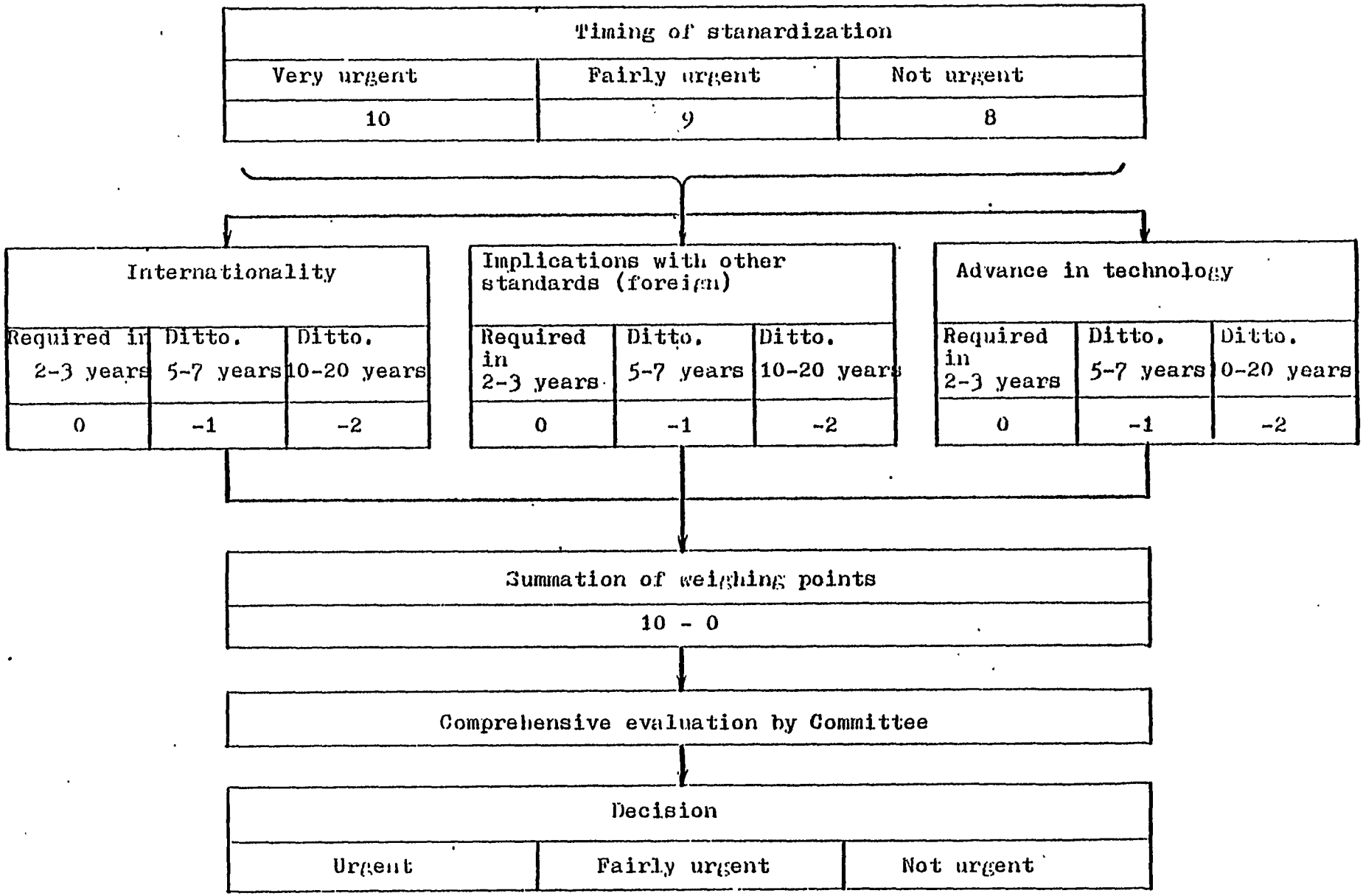


Figure 2-6 Summary of Evaluations (Example)

Replies of Enquete				Decisions of the Committee														
				Evaluation of eligibility							Evaluation of priority							
				Evaluation Factors							Evaluation Factors							
Area of standard's development	Desired standard's classification	Standard's description	Desired priority order	Contribution to industry	Internationality	Impact on other standard	Technical value	Longevity	Summation	Result of Evaluation	Standardization Timing	Internationality	Impact on other standard	Advance in Technology	Summation	Result of Evaluation	Year of Development	Remarks
Common	Design	Calcul'n method 24V d.c. line, insulation	A							X								
Auxiliary Machinery	"	Shaft driven generator	A															
Electric Outfitting	"	Design std. for shaft driven generator	A	80	-20	0	0	-5	55	0	9	-1	-1	-1	6	B	'83	New standard
	"	Design std. for saving energy in generator design	A															
	"	Application std. for marine-use electric cables	C	60	-20	0	-20	-5	15	X								
	"	Std. for illumination intensity	B	100	0	0	-10	0	90	0	10	0	0	0	10	A	'81	New standard
	"	Application std. for cable penetration glands	B							X								
	"	Application std. for cable armor in dangerous gas/oil/steam accumulated areas.	B	80	-20	0	-10	-10	40	X								
	Production Process	Work process std. for elec. outfitting of D.C. class hulls	B	60	-20	-10	-10	-20	10	X								
	Products	Watertight flurescent lamps	A	80	0	0	0	0	80	0	9	-1	-1	-1	6	A	'81	Revision of Existing standard

2.6 STANDARDS PROGRAM ADMINISTRATIVE GUIDELINES

2.6.1 Documentation

Approval and publication is the final process of standards development. The standards must be documented so that the contents of the standard, such as its objective, functions, structure, dimensions, material, etc., are uniform and consistent. To assure that all necessary information is provided, it is recommended that a standard format for publication be established. (Noting that organizations such as ASTM already prescribe standard format.)

As an example, the standard format for publication could include the following:

1) Scope of application
2) Terminology and definitions
3) Type and class
4) Functional characteristics
5) Chemical and physical contents of materials
6) Composition
7) Construction
8) Configuration
9) Dimensions, measurements
10) External appearances
11) Qualities
12) Material
13) Fabrication and manufacturing methods
14) Appurtenances and spares
15) Testing method
16) Inspection method
17) Packing method
18) Nomenclature, code
19) Labeling
20) Instructions for application

Detailed examples of the format of JIS standards are included in APPENDIX II-C.

2.6.2 Application

Appropriate measures should be established to encourage the application of standards and to realize potential benefits.

The approach to encourage standards application will be different for the various categories. The following are some preliminary recommendations:

1) National Standards

a) The use of national standards should be encouraged through Federal rules and regulations. This is now actually occurring in the Code of Federal Regulations (CFR) by invoking ASTM, ANSI, ABS requirements, specifications, etc. for application. National standards can be invoked in the same way.

b) It may be desirable to register all national standards in the form of an approved standards list as part of the CFR, somewhat similar to the Qualified Products List used by the U.S. Coast Guard.

c) As a further measure, it is advisable to evaluate the establishment of a system to license manufacturers to manufacture and sell national standards products under the government's supervision, similar to the "JIS-license" system applied in Japan. Manufacturers who are qualified through government inspections on production facilities and quality control methods, are granted permission by the government to sell their JIS product bearing the "JIS" mark indicating that the product quality and performance is guaranteed to comply with JIS specifications. No inspection is required for each JIS product once the license is granted. This is similar to the ASTM or UL labeling system applied in the U.S. Inspections for qualification can be assigned to ASTM or UL, etc. by the government.

d) National standards should be included in Maritime Administration's "Standard Specification for Merchant Ships Construction" and applicable U.S. Navy specifications.

2) Industry Voluntary Standards

a) In contrast with national standards, industry voluntary standards should be considered intrinsically as semi-national standards. Therefore, industry voluntary standards should be authorized and invoked or referred to in Federal rules and regulations with some resiliency in application.

b) Each responsible organization could also consider a licensing system similar to that recommended for national standards. This system encourages manufacturers to increase their share in the market by improving their productivity through standardized production.

c) Industry voluntary standards should be included or invoked in Maritime Administration's

and/or applicable Navy specifications as appropriate.

3) Company In-house Standards

a) Although they are not as broadly applied as national or industry standards, company standards should be authorized and required for application within the company.

b) Company standards should be documented and distributed to buyers, regulatory bodies, classification society, etc., for approval, and included in or attached as an integral part of the contract specifications and plans.

2.6.3 Publication and Distribution Procedures for Publicizing Standards

Once the standard is established, it must be publicized and distributed to the users to promote its application and achieve the benefits of standardization. Public relations activities should be continued incessantly until the standard is recognized and accepted by the users.

The method of publicizing is somewhat different between national standards, industry standards and company standards. Company standards can be enforced rather easily by in-house procedures. Therefore, the methods described herein are guidelines for publicizing national and/or industry standards. The public relations approach adopted in Japan is described for reference.

A. Publicizing System in Japan

70 1. National Standards

The methods used for publicizing JIS standards include publications, exposition meetings, and also incentive programs to encourage application. The government also supports application of JIS by prioritizing JIS requirements in all government projects, etc.

JIS standards are publicized through two different channels; one through the government itself, and the other through government supported organizations. The following are the major activities conducted by the two sources.

A) Government Activities

a) Public announcement of the standard through the government's Official Gazette
b) Supervision of printing and distribution of standards
c) Requiring priority use of JIS and JIS-marked products in government projects, etc.
d) Promotion of technical courses to promote industrial standardization
e) Providing awards for contributions to industrial standardization
f) Implementation of promotion programs to encourage standardization
g) Encouraging JIS application overseas

B) Government Supported Organization Activities (JSA)

a) Issue JIS publications
b) Issue English versions of JIS publications
c) Issue monthly magazines, i.e., "Standardization Journal" and "Standardization & Quality Control"
d) Issue books, e.g., JIS Catalogue, JIS Terminology Dictionary, etc.
e) Issue JSA Technical Report
f) Make standard specimens, formats, models
g) Promote expositions, conferences and symposia to promote JIS standards
h) Promote Q-S (Quality Control and Standardization) national/local conferences
i) Promote monthly local Quality Assurance Conferences
j) Promulgation of JSA standardization literature
k) Maintain a library of foreign standards

2. Industry Standards

Basically, the publicizing system is similar to JIS, but for shipbuilding standards, the effort is limited to the marine and shipbuilding industries.

The major activities include the following:

a) Issue bulletins and technical reports
b) Distribute progress reports on standardization and summarize the status of standards through bulletins
c) Issue standards booklets
d) Maintain a library service open to the public

B. Publicity Approach Recommended for U.S. Shipbuilding Standards

1. National Standards

It is conceivable that a publicizing system similar to JIS can be applied in the U.S. by substituting MarAd, USN, USCG, ABS for the governmental agency and ASTM/ANSI for supporting organizations.

The following are the major activities recommended:

a) Public announcement of standards through

the Federal Register or other publications:

The announcement should include:

— Name of standard

- Code number of the standard

- Data of approval revision confirmation of continuity or discontinuity, whichever the Case may be.

b) Issue, distribution and review of Standards:
Following public announcement the standards should be printed and distributed promptly to all segments of the industry, permitting review by the public.

c) Advertisement through prees and magazines:
New standards or revised standards should be advertised periodically in marine papers and magazines with simple explanations, prices of prints, where to order, etc.

d) Publicity through meetings, seminars:
Exposition meetings or seminars are an effective method for introducing new standards to the industry by explaining standard features, proper interpretations, instructions for use, etc.

e) Implement promotional activities:
To stimulate standardization throughout the industry, it is also effective to distribute posters, pamphlets, slogans, or other information to shipyards, manufactures and other intereated fields.

f) issue standards booklets:
Issue convenient booklets or other documents containing standards to facilitate user application.

2. Industry Voluntary Standards

The Publicizing system and activities could be Similar to those used for national standards but accomplished by ASTM.

The major activities should include:

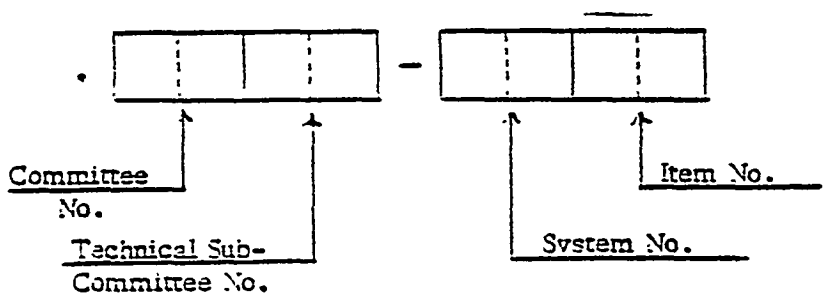
a) Announcement of standards through bulletins
b) Publication and distribution of standards to the parties concerned
c) Issue of standards booklets, etc.

2.6.4 Coding Guidelines
structure of Standards Codes

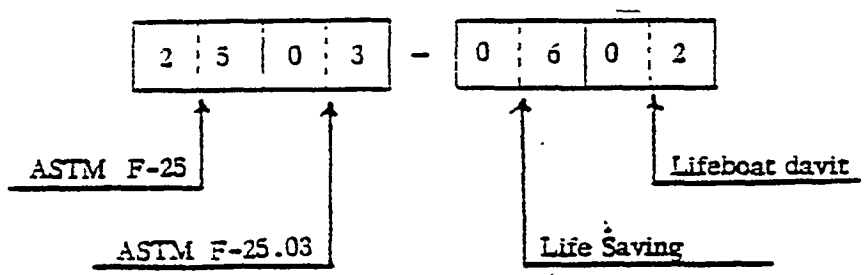
To control, maintain and effectively utilize the numerous standards developed in various fields, it is essential to establish ineffective coding system to classify and file the standards utilizing computer.

The code numbers should be devised to provide some definition or meaning so that the designator can indicate its correlation with the development source, system, etc., for easy identification.

The following code system is recommended utilizing the ASTM F-25 Committee codes in four digits to identify its source and using two digit numbers to identify the system and two digit numbers to identify the item itself.



For example, the following code number indicates a "boat davit" (02) belonging to the "life saving system" (06), developed and controlled by the "outfitting" (03) Technical Sub-Committee of ASTM-Committee F-25 (25) for shipbuilding standards:



The sample code numbers for identifying various "systems" are shown in APPENDIX II-D. The code number for each "item" could be defined in the same manner.

By establishing a code system common for the industry, benefits would accrue not only to the shipbuilders, but also suppliers, shipowners, regulatory bodies, etc., for easy identification.

Coding System for Computer Utilization

1) Areas of Utilization

To use the standards codes as material codes for material control by computers, it is desirable to establish a more detailed code system which defines the item more specifically.

The following are the major areas where the standards codes can be utilized:

a) Filing of standards
b) Maintenance of standards
c) Identify its usage and application by the industry
d) Material preparation
e) Material control, i.e., ordering, material delivery, material receival
f) Identify workers' workload
g) Production schedule control
h) Common language for communication and information

Figure 2-7 delineates the correlation between the material code and other activities.

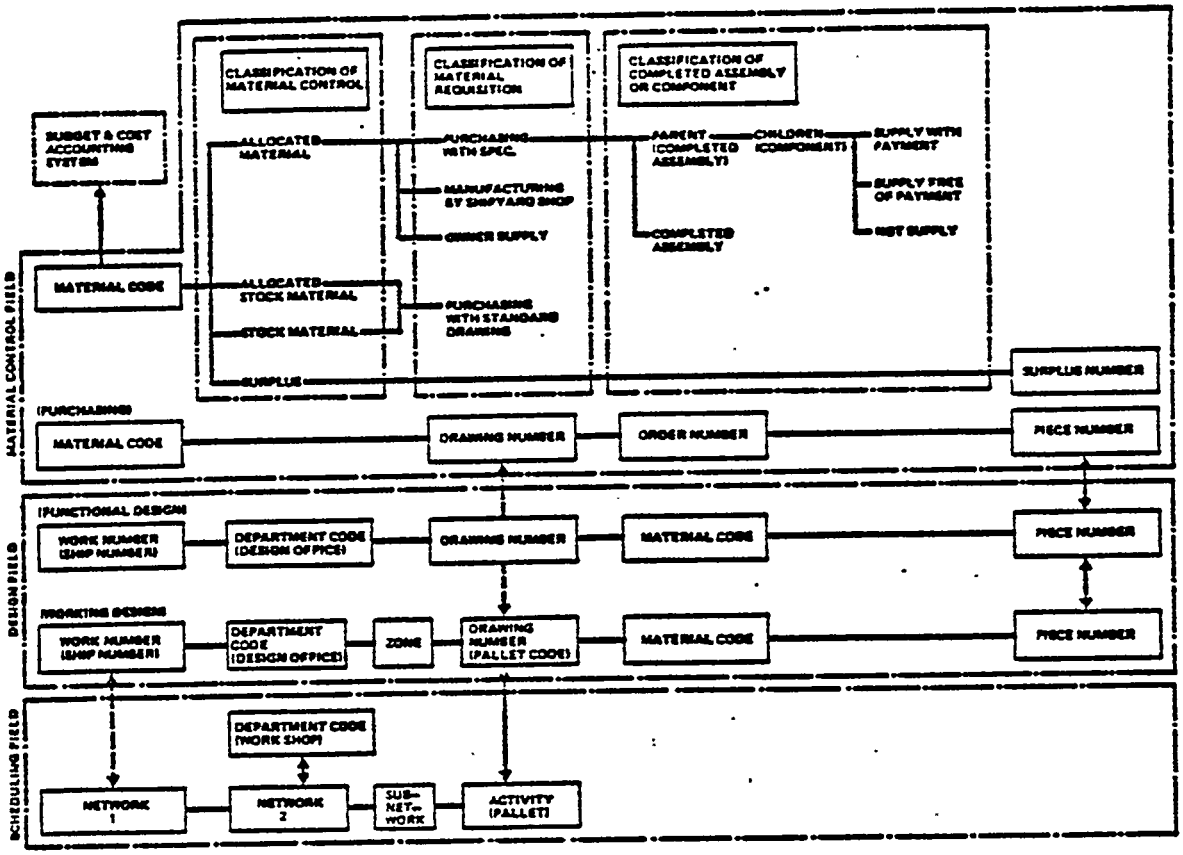


Figure 2-7 Correlation between Material Codes and other activities

2) Functions Required

To add further information to the standards code, and to utilize them for material codes and/or other purposes as previously mentioned, a detailed coding system is required to identify the standards' characteristics. The detailed coding system should meet the following requirements:

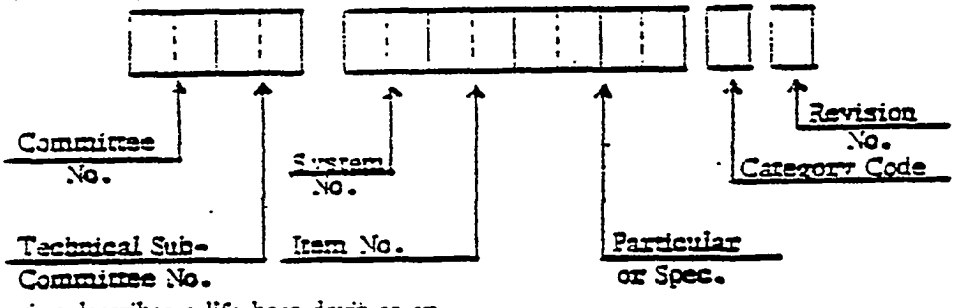
a) Should be versatile so that it can be utilized in many areas.
b) Should be capable of identifying a specific article.
c) Should be capable of identifying the characteristics (particulars, specifications) of a specific article.
d) The structure of the code should be based on established logic.
e) Should be capable of identifying the article's category (e.g. hull, machinery, electric, etc.)
f) Should be capable of identifying its status (e.g. original or revised).
g) Should indicate the standard's category (national, industry or company).
h) Should permit future revision or supplementation.

3) Structure of a Detailed Coding System

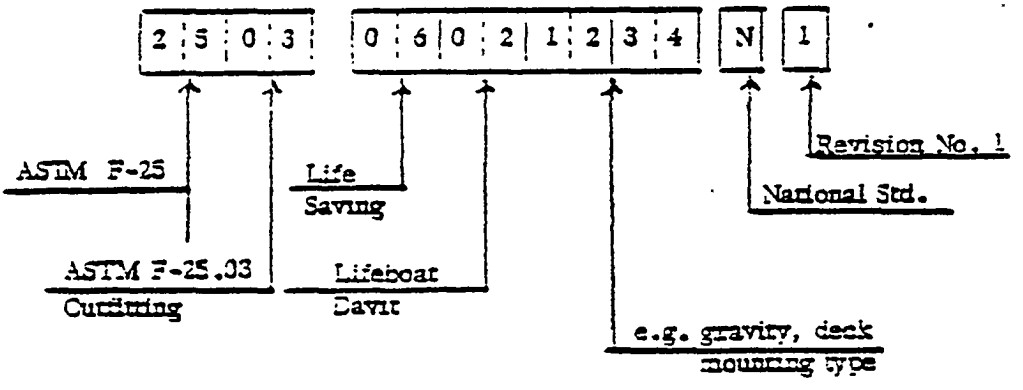
In developing the code structure, the following must be considered:

a) The total number of digits should not be too extensive.
b) Is it desirable to use either the numbers or letters for coding? If alphanumerics are combined, their purpose must be distinguished.
c) Considering utilization of computers, the coding should be designed not to exceed the computer capacity.

Based on these considerations, the following is one example of the code structure:



The following describes a life boat davit as an example:



The above is only one example of a detailed coding system. The number of digits can either be reduced or expanded, depending upon user requirements.

Note: Although this code system is intended primarily for standard identification, the same system can be utilized for other purposes.

For reference, the material coding system used in IHI is shown in Figure 2-8.

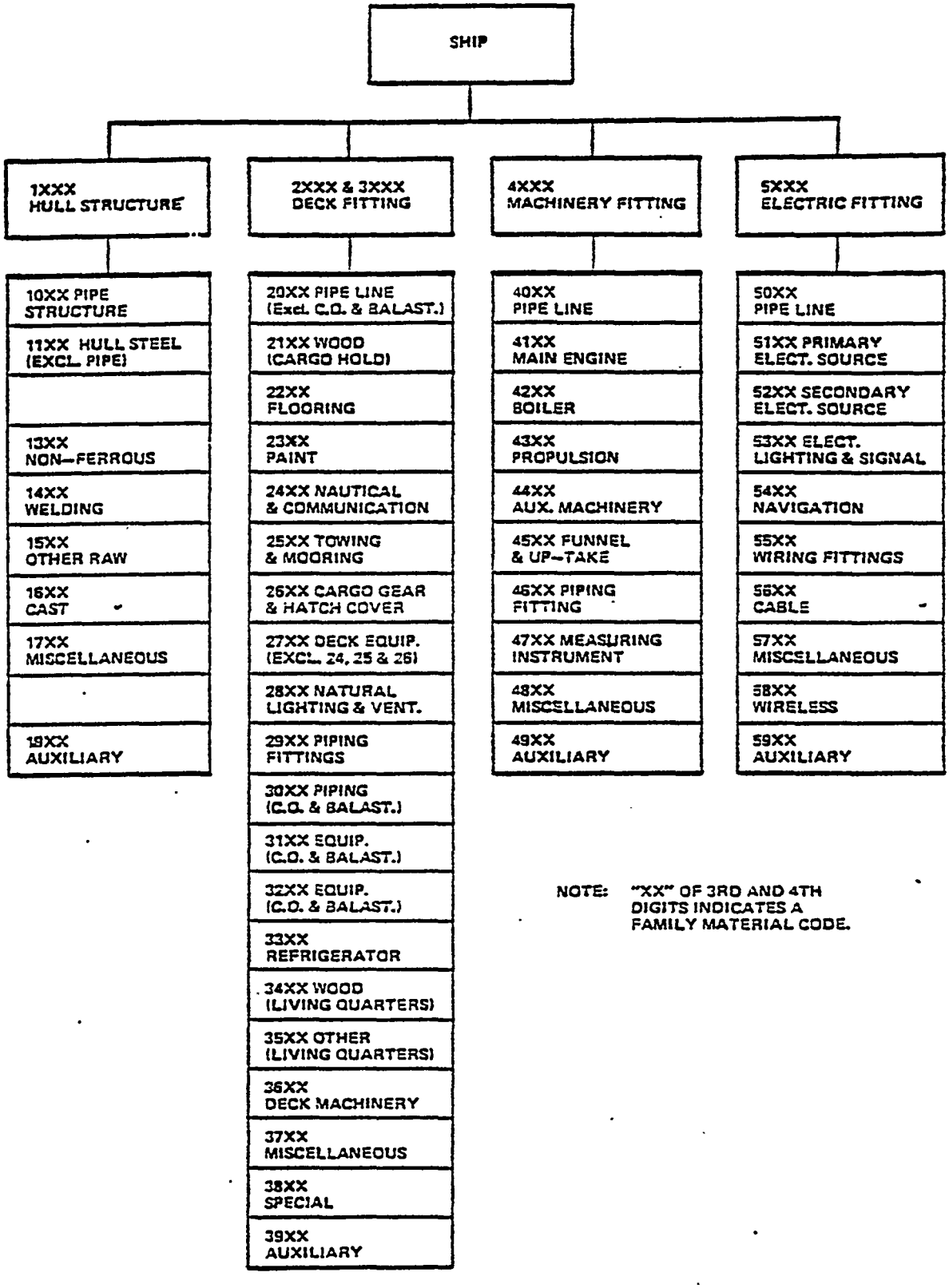


FIGURE 2-8 STRUCTURE OF MATERIAL COST CLASSIFICATION

2.6.5 *Maintenance*

At each standards level, the standardization long-range plan and individual standards should be reviewed periodically to reflect changes in requirements, advances in technology and other influential factors. The following are some of the guidelines for follow-up and maintenance.

1) Long-Range Plans

Long-range plans and annual development plans should be reviewed annually to pursue ongoing and future development of standards, and revised as necessary.

2) Individual Standards

All standards should be reviewed every three to five years to assess and determine its currency, needed modifications, etc., depending on different requirements, feedback from users, advances in technology, etc. Immediate action should be taken to correct any defects reported by users. A documented feedback system should be established to facilitate effective feedback.

SHIP PRODUCIBILITY RESEARCH PROGRAM
TASK S-29

RECOMMENDED
U. S. SHIPBUILDING STANDARDS PROGRAM

LONG-RANGE PLAN

VOLUME II

RECOMMENDED U. S. SHIPBUILDING STANDARDS

LONG-RANGE PLAN

APPENDICES

IHI MARINE TECHNOLOGY, INC.
ISHIKAWAJIMA-HAIWW HEAVY INDUSTRIES CO., LTD.

RECOMMENDED
U. S. SHIPBUILDING STANDARDS PROGRAM

LONG-RANGE PLAN

VOLUME II

APPENDIX II-A

TREE STRUCTURE OF STANDARDIZATION ITEMS

RECOMMENDED
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LONG-RANGE PLAN

VOLUME II

APPENDIX II-B

STANDARDIZATION ITEMS

PRIORITY ORDERS
CLASSIFIED BY TYPES OF STANDARDS

APPENDIX II-B
EXPLANATIONS

1. RATIONALE

This column indicates the effects or benefits of standardization. 2 to 4 most effective rationales are selected for each standard.

01 - Improve communication, save labor (e.g. smoother negotiations, minimize conflicts)
02 - Improve approval work, save labor (e.g. simplify plan approval, shorten approval time)
03 - Improve inspection work, save labor (e.g. simplify/eliminate inspection, shorten inspection time, eliminate duplication)
04 - Improve design/engineering work, save labor (e.g. reduce engineering manhours, minimize design changes, improve accuracy of drawings.)
05 - Improve purchasing work, save labor (e.g. simplify ordering, minimize estimation work)
06 - Improve production, save labor (e.g. improve productivity, reduce manhours)
07 - Stabilize or improve technology level (e.g. stabilize and improve engineering and production technology, eliminate inconsistency in design or specifications)
08 - Maintain or improve quality (e.g. maintain quality, improve reliability)
09 - Reduce cost, (e.g. avoid over design, reduce tailor-made products)
10 - Shorten delivery time (e.g. reduce purchasing time, allow stocks)

2. STATUS

This column indicates the organization, rule or regulation, institute, etc., issuing and controlling the standard.

3. CATEGORY

This column indicates characteristics of the standard.

N — National standard
I — Industry-wide standard
H — Company in-house standard

4. F-25 COMMITTEE

This column indicates the code number of ASTM F-25 sub-committees.

5. ABBREVIATIONS

U.S.A.

USA

MASS	Maritime Administration "Standard Specification for Merchant Ship Construction"
MASSD	Ditto. "Standard Specification for Diesel Merchant Ship Construction"

Foreign

BV	Bureau Veritas (France)
IACS	International Association of Classification Societies
ISO	International Organization for Standardization
IEC	International Electrotechnical Commission
IMCO	Inter-government Maritime Consultative Organization
DIN	Deutsche (Industrie) Normen (West Germany)
JIS	Japanese Industrial Standards
PCC	Panama Canal Regulations

SHORT-TERM STANDARD ITEMS

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Bolts & nuts	04, 05 08, 10	ANSI ASTM MIL	N	01
2	Rivets	04, 05 08, 10	ANSI ASTM	N	01
3	Tapping screws	04, 05 08, 10	ANSI	N	01
4	Wood screws	04, 05 08, 10	ANSI	N	01
5	Washers	04, 05 08, 10	ANSI ASTM	N	01
6	Nails	04, 05 08, 10	JIS	N	01
7	Set pins for joiner insulation	04, 05 08	-	I/H	01
8	Metal laths, expanded metal, etc.	04, 05 08, 10	JIS	I/H	01
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Manhole covers, Access hatch covers, etc.	02, 04 05, 08	MASS ABS ISO	N/I	03
2	Rigging, Blocks	02, 04 05, 08	MASS	N/I	03
3	Anchors	02, 04 05, 08	MASS ABS ISO	N/I	03
4	Anchor chains	02, 04 05, 08	MASS ABS ISO	N/I	03
5	Chain stoppers	02, 04 05, 08	MASS ISO	N/I	03
6	Bitts, Bollards	02, 04 05, 08	FCC ISO	N/I	03
7	Panama chocks	02, 04 05, 08	FCC ISO	N/I	03
8	Eye plates, Ring plates	04, 05 08, 10	MASS DIN JIS	N/I	03
9	Handrails, Handrail stanchions	04, 05 08, 10	MASS ISO	N/I	03
10	Steps, Vertical ladders	04, 05 08, 10	MASS ISO	N/I	03
11	Pilot ladders	02, 04 05, 08	ISO	N/I	03
12	Embarkation ladders	02, 04 05, 08	ISO	N/I	03
13	Weather/Watertight steel doors	02, 04 05, 08	MASS ISO	N/I	03
14	Side scuttles, Square windows	02, 04 05, 08	MASS ABS ISO	N/I	03
15	Bottom plugs	04, 05 08, 10	ISO	N/I	03
16	Builder's name plate	05	-	H	03
17					

Short-term Products Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Ventilator heads	02, 04 05, 08	MARAD ABS ISO	N/I	05
2	Pankah louvers	04, 05 08, 10	MARAD JIS	N/I	05
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16					
17					

NO	ITEM	RATIONALE	STATUS	CATEGORY	F-25 COMM
1	Incandescent lighting fixtures	04, 05 08, 10	USCG IEEE UL	N/I	10
2	Fluorescent lighting fixtures	04, 05 08, 10	USCG IEEE UL	N/I	10
3	Electric cable ways and fittings	04, 05 08, 10	USCG IEEE UL	N/I	10
4	Electric bulbs	04, 05 08, 10	USCG IEEE UL	N	10
5	Basic parts of small electric fixture	04, 05 08, 10	USCG IEEE UL	N/I	10
6	Signal lights	02, 04 05, 08	USCG IEEE UL	N/I	10
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Boiler and heat exchanger tubes	04, 05 08, 10	ASTM	N	11
2	Level gauges for tanks and pressure vessels	04, 05 08, 09	-	N	11
3	Sight glasses for tanks	04, 05 08, 09	BV	N/I	11
4	Expansion Joints for exhaust gas pipes	04, 05 07, 08	BV	H	11
5	Expansion Joints for dampers for boiler cold start	04, 05 07, 08	MASS	H	11
6	Dampers for boiler cold start	04, 05 07, 08	MASS	H	11
7	Flanges for exhaust gas pipes and up-take	04, 05 07, 08	-	H	11
8	Inspection hole for up-take, exhaust gas pipes and forced Draft Fan trunks	04, 05 07, 08	-	H	11
9	Dampers for exhaust fan trunks	04, 05 07, 08	-	H	11
10	Pressure gauge boards	04, 05 08, 09	MASS	N/I	11
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NO	ITEM	RATIONALE	STATUS	CATEGORY	F-25 COMM
1	Steel pipes, Steel alloy pipes	04, 05 08, 10	ANSI ABS ISO	N	13
2	Non-ferrous pipes	04, 05 08, 10	ASTM ABS JIS	N	13
3	Plastic pipes	04, 05 08, 10	ANSI ASTM JIS	N	13
4	Flanges for steel pipes	04, 05 08, 10	MASS ANSI ISO	N	13
5	Flanges for non-ferrous pipes	04, 05 08, 10	ANSI JIS	N	13
6	Flanges for plastic pipes	04, 05 08, 10	-	H	13
7	Welding joints for steel pipes	04, 05 08, 10	ANSI ISO JIS	N	13
8	Joints for non-ferrous pipes	04, 05 08, 10	MASS ANSI	N/I	13
9	Union joints for pipes	04, 05 08, 10	BV JIS	N	13
10	Joints for plastic pipes	04, 05 08, 10	ASTM BV JIS	N	13
11	Flange gaskets	04, 05 08, 10	ANSI BV JIS	N	13
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Short-term Products Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Standard for screw threads	02 04	ANSI ISO	N	01
2	Terminology and Symbols for screw threads	01 04	ANSI JIS	N	01
3	Classification standard for metallic materials	04 07	ASTM JIS	N	01
4	Comparision table of foreign metallic material standards	04 07	JIS	N/I	01
5	Classification standard for non-ferrous metal materials	04 07	ANSI ASTM JIS	N	01
6	Comparision table of foreign non-ferrous metal material standards	04 07	JIS	N/I	01
7	Classification standard for wood material	04 07	ASTM	N	01
8	Terminology for plastic materials	01 04	ASTM JIS	N	01
9	Indication practice for electroplating	01 04	JIS	N	01
10	Terminology for electroplating	01 04	JIS	N	01
11	Terminology for steel heat treatment	01 04	JIS	N	01
12	Terminology for rubber materials	01 04	JIS	N	01
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14					
15					
16					
17					

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Installation standard for pilot ladders	04 08	IMCO SOLAS PCC	N/I	03
2	Standard supply scope of inventory and spares	02 04	MASS FED	N/I	03
3	Graphic symbols for fire control plan	01 04	ISO JIS	N	03
4	Graphic symbols for life saving equipment and outfit	01 04	ISO JIS	N	03
5	Symbols for ship fitted with bulbous bow and/or side thruster	02 04	MASS MIL ISO	N	03
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Application standard for rolled steel plates for hull structure	04 08	ABS	I	04
2	Application standard for steel sections for hull structure	04 08	ABS	I	04
3	Application standard for aluminum alloy plates for hull structure	04 08	ABS	I	04
4	Application standard for aluminum alloy sections for hull structure	04 08	ABS	I	04
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Short-term Design/Engineering Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	P-25 COMM
1	Graphic symbols for ventilation system	01 04	ISO	N	05
2	Identification colours for ventilation system	01 04	ISO	N	05
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Standard procedure for selection and development of standard items	01 04	-	N/I/H	07
2	Standard procedure for maintenance of standards	01 04	-	N/I/H	07
3	Standard procedure for custody of standards	01 04	-	N/I/H	07
4	Standard for coding system	01 04	-	N/I/H	07
5	Format of standard drawings	01 04	ASME ANSI DOD	N/I	07
6	General requirement for drafting	01 04	ANSI ISO	N	07
7	Quantity symbols, Unit symbols and Conversion rates	01 04	ANSI ISO	N	07
8	Limit and fit for engineering	01 04	ANSI MIL ISO	N	07
9	Application standard for tolerance limits	01 04	ISO	N	07
10	Surface texture	01 04	ANSI ISO	N	07
11	Classification symbols for vessels	01 04	ABS	N	07
12	Classification of vessels	01 04	ABS	N	07
13	Standard for weather and sea condition	01 02	ABS	N	07
14	Safety signs and safety colours	02 04	ISO	N	07
15	Design standard for freeboard and freeboard mark	02 04	ABS	N	07
16	Format on the general arrangement plans of ships	02 04	ISO	N	07
17	Standard of colours	01 04	-	N	07

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Graphical symbols for electric equipment on drawings	01 04	USCG JIC IEC	N	10
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Graphic symbols for machinery equipment on machinery schematic drawings	01 04	(ISO)	N	11
2	Physical properties of heat exchangers	04 08	TEMA	N/I	11
3					
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15					
16					
17					

NO	ITEM	RATIONALE	STATUS	CATEGORY	F-25 COMM
1	Symbols for welding	01 04	ISO	N	12
2	Standard strength calculation method for welding parts	04 07	ISO	N	12
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16					
17					

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Graphic symbols for piping system	01 04	MARAD ISO	N	13
2	Identification colours for piping system	01 04	ISO	N	13
3	Application standard for pipes	04 08	MASS ASTM ABS	N	13
4	Application standard for valves	04 08	MASS ANSI ABS	N	13
5	Standard face to face dimensions for valves	01 04	ANSI ISO	N/I	13
6	Application standard for flanges	04 08	ABS	I/H	13
7	Application standard for welding joints for steel pipes	04 08	ABS	I/H	13
8	Application standard for joints for non-ferrous pipes	04 08	ABS	I/H	13
9	Application standard for union joints for piping	04 08	ABS	I/H	13
10	Application standard for joints for plastic pipes	04 08	ABS	I/H	13
11	Application standard for gaskets and packing for piping	04 08	JIS	I/H	13
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NO	ITEM	RATIONALE	STATUS	CATEGORY	P-25 COMM
1	Terminology for shipbuilding	01 04	ABS ISO IEC	N	93
2	Terminology for noise and vibration	01 04	ANSI ISO	N	93
3	Terminology for containers	01 04	ABS ISO JIS	N	93
4	Terminology for computer application	01 04	ISO	N	93
5	Terminology for balancing	01 04	ISO	N	93
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NO	ITEM	RATIONALE	STATUS	CATEGORY	F-25 COMM
1	Rolled steel plates and shapes	04, 05 08, 10	ANSI ASTM JIS	N	01
2	Steel bars and steel wires	04, 05 08, 10	ANSI ASTM JIS	N	01
3	Steel pipes	04, 05 08, 10	ASTM ISO JIS	N	01
4	Steel wire ropes	04, 05 08, 10	ISO ASTM JIS	N	01
5	Carbon steel for machine structure	04, 05 08, 10	ASTM JIS	N	01
6	Stainless steel plates and shapes	04, 05 08, 10	AISI JIS	N	01
7	Stainless steel bars and wires	04, 05 08, 10	AISI JIS	N	01
8	Stainless steel pipes	04, 05 08, 10	ASTM JIS	N	01
9	Steel for tools	04, 05 08	AISI JIS	N	01
10	Steel castings	04, 05 08	ASTM MIL	N	01
11	Iron castings	04, 05 08	ASTM MIL JIS	N	01
12	Steel forgings	04, 05 08	ISO ASTM JIS	N	01
13	Copper and copper alloy sheets	04, 05 08, 10	ASTM JIS	N	01
14	Copper and copper alloy bars and wires	04, 05 08, 10	ASTM JIS	N	01
15	Copper and copper alloy pipes	04, 05 08, 10	ASTM JIS	N	01
16	Aluminum and aluminum alloy sheets and extruded shapes	04, 05 08, 10	ASTM FED JIS	N	01
17	Aluminum and aluminum alloy bars and wires	04, 05 08, 10	ASTM FED JIS	N	01

NO	ITEM	RATIONALE	STATUS	CATEGORY	F-25 COMM
18	Aluminum and aluminum alloy pipe	04, 05 08, 10	ASTM FED JIS	N	01
19	Plates and shapes of magnesium alloy, nickel alloy, etc.	04, 05 08	ASTM JIS	N	01
20	Bars and wires of magnesium alloy, nickel alloy, etc.	04, 05 08	ASTM JIS	N	01
21	Pipes of magnesium alloy, nickel alloy, etc.	04, 05 08	ASTM JIS	N	01
22	Brass castings, bronze castings	04, 05 08, 10	ASTM JIS	N	01
23	Aluminum alloy castings	04, 05 08, 10	ASTM JIS	N	01
24	Castings of magnesium alloy, etc.	04, 05 08	ASTM JIS	N	01
25	Aluminum alloy forgings	04, 05 08	ASTM JIS	N	01
26	Thermoplastics	04, 05 08	JIS	N	01
27	Thermosetting plastics	04, 05 08	JIS	N	01
28	Unplasticized polyvinyl chloride pipe	04, 05 08, 10	JIS	N	01
29	Insulation materials (Glass wool, rock wool)	04, 05 08, 10	JIS	N	01
30	Asbestos	04, 05 08	JIS	N	01
31	Fibre ropes	04, 05 08, 10	JIS	N	01
32	Canvas	04, 05 08, 10	JIS	N	01
33	Wood	04, 05 08, 10	-	N	01
34	Adhesives	04, 05 08, 10	JIS	N	01

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
35	Cement	04, 05 08, 10	ASTM ABS JIS	N	01
36	Coating materials	04, 05 08	FED JIS	N	01
37	Sand for casting	04, 05 08, 10	MIL JIS	N	01
38	Tiles	04, 05 08, 10	JIS	N	01
39	Materials for electric equipment	04, 05 08	JIS	N	01
40	Materials for surface treatment	04, 05 08	ASTM JIS	N	01

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Pigment	01 04 08	ASTM FED	N	02
2	Liquid paint driers	01 04 08	ASTM	N	02
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15					
16					
17					

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Magnetic compasses	02, 04 08	MASS ISO	N	03
2	Navigation equipment	02, 04 08	MASS	N	03
3	Signal equipment	02, 04 08	MASS	N	03
4	Whistles	02, 04 08	MASS	N	03
5	Fire extinguishing equipment	02, 04 08	MASS ABS	N	03
6	Life rafts	02, 04 08	MASS ISO	N	03
7	Life boats	02, 04 08	MASS	N	03
8	Life saving and life saving signal equipment	02, 04 08	MASS	N	03
9	Boat davits	02, 04 08	MASS	N	03
10	Boat winches	02, 04 08	MASS	N	03
11	Ship's side ladders	01, 04 08	MASS ISO	N	03
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NO	ITEM	RATIO-NALE	STATUS	CATE-GORY	F-25 COMM
1	Windlass	02 04 08	SNAME ISO	N	08
2	Mooring winches	02 04 08	ISO	N	08
3	Cargo winches	02 04 08	ISO	N	08
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Electric motors	02, 04 08	MASS ABS IEC	N	10
2	Protective device for electric equipment	02, 04 08	MASS ABS IEC	N	10
3	Cables & flexible cords for electric equipment	02, 04 08	MASS ABS IEC	N	10
4	Generators	02, 04 08	MASS ABS IEC	N	10
5	Switchboards	02, 04 08	MASS ABS IEC	N	10
6	Batteries	02, 04 08	MASS ABS IEC	N	10
7	Dry-type transformers	02, 04 08	MASS ABS IEC	N	10
8	General requirements for construction of electric explosion-proof equipment	02, 04 08	MASS USCG IEC	N	10
9	General requirements for construction of electric lighting fixtures	02, 04 08	USCG UL IEEE	N	10
10	Incandescent lighting fixtures	02, 04 08	MASS UL IEC	N	10
11	Fluorescent lighting fixtures	02, 04 08	MASS UL IEC	N	10
12	Floodlight projectors and cargo lights	02, 04 08	MASS UL IEC	N	10
13	Electric navigation lights and daylight signaling lamps	02, 04 08	MASS USCG IEEE	N	10
14	Electrical navigation equipment	02, 04 08	MASS USCG ABS	N	10
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Auxiary boilers	01 04 08	MASS	N/I	11
2	Condensers	01 04 08	MASS	N/I	11
3	Fresh water coolers	01 04 08	MASS	N/I	11
4	Lubricating oil coolers	01 04 08	MASS	N/I	11
5	Butterworth heaters and drain coolers	01 04 08	MASS	N/I	11
6	Feed water heaters for boilers	01 04 08	MASS	N/I	11
7	Fuel oil heaters for boilers	01 04 08	MASS	N/I	11
8	Fuel oil purifiers	01 04 08	MASS	N/I	11
9	Air compressors	01 04 08	MASS	N/I	11
10	Pressure gauges	02 04 08	ANSI MASS JIS	N/I	11
11	Thermometers	02 04 08	MASS JIS	N/I	11
12	Heat exchangers	01 04 08	MASS	N/I	11
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Cast iron globe valves	02 04 08	ANSI ISO	N	13
2	Cast iron angle valves	02 04 08	ANSI ISO	N	13
3	Cast iron gate valves	02 04 08	ANSI ISO	N	13
4	Cast steel and forged steel globe valves	02 04 08	MASS ANSI	N	13
5	Cast steel and forged steel angle valves	02 04 08	MASS ANSI	N	13
6	Cast steel and forged steel gate valves	02 04 08	MASS ANSI	N	13
7	Bronze globe valves	02 04 08	MASS ANSI ISO	N	13
8	Bronze angle valves	02 04 08	MASS ANSI ISO	N	13
9	Bronze gate valves	02 04 08	MASS ANSI ISO	N	13
10	Cast steel gate valves fitted to hull	02 04 08	ANSI UL	N	13
11	Cast steel angle valves fitted to hull	02 04 08	ANSI UL	N	13
12	Relief valves	01, 02 04, 08	MASS ANSI ABS	N/I	13
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	General requirements for inspection of metallic materials	01, 03 08	ASTM JIS	N/I	01
2	Standard method for inspection of metallic materials	01, 03 08	ASTM JIS	N/I	01
3	General requirements for inspection of non-ferrous metallic materials	01, 03 08	ASTM JIS	N/I	01
4	Standard method for inspection of non-ferrous metallic materials	01, 03 08	ASTM JIS	N/I	01
5	Standard method for inspection of plastics	01, 03 08	ASTM JIS	N/I	01
6	Standard method for inspection of wood material	01, 03 08	JIS	N/I	01
7	Standard method for inspection of rubber material	01, 03 08	JIS	N/I	01
8	Standard method for inspection of adhesives	01, 03 08	JIS	N/I	01
9	Standard method for inspection of electric equipment materials	01, 03 08	JIS	N/I	01
10	Standard method for inspection of surface treatment	01, 03 08	JIS	N/I	01
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Standard for qualitative test for paints	03 08	ASTM	N/I	02
2	Standard for qualitative test for pigments	03 08	ASTM	N/I	02
3	Standard method for preparation of specimens for paint test	03 08	ASTM	N/I	02
4	Standard for qualitative test of liquid paint driers	03 08	ASTM	N/I	02
5	Assessment standard for evaluation of environments by coated specimens	03 08	ASTM	N/I	02
6	Standard method for measuring the specific gravity of paints, pigments and driers	03 08	ASTM	N/I	02
7	Standard for performance test for plastics	03 08	ASTM	N/I	02
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Short-term Testing/Inspection Standards

NO	ITEM	RATIONALE	STATUS	CATEGORY	F-25 COMM
1	Inspection standard for anchor	01, 03 08	MASS ABS ISO	N	03
2	Inspection standard for anchor chains	01, 03 08	MASS ABS ISO	N	03
3	Inspection standard for rigging, lines, blocks	01, 03 08	MASS	N	03
4	Inspection standard for equipment for navigation, signal, fire extinguishing, etc.	01, 03 08	MASS	N	03
5	Inspection standard for life boats	01, 03 08	MASS	N	03
6	Inspection standard for boat davits/winches	01, 03 08	MASS	N	03
7	Inspection standard for round scuttles, windows	01, 03 08	MASS ABS ISO	N	03
8	Inspection standard for ship's side ladders	01, 03 08	MASS ISO	N	03
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Inspection standard for windlasses	01, 03 08	SNAME	N	03
2	Inspection standard for mooring winches	01, 03 08	ISO	N	03
3	Inspection standard for cargo winches	01, 03 08	ISO	N	03
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Short-term Testing/Inspection Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COM
1	General requirements for degree of protection & inspection of enclosures for electric equipment	01, 03 08	IEC IEEE JIS	N	10
2	General requirements for inspection of electric explosion proof equipment	01, 03 08	MASS JIS IEC	N	10
3	General rules for temperature tests for electric lighting fixtures	01, 03 08	USCG UL JIS	N	10
4	General requirements for vibration tests for electric equipment	01, 03 08	JIS	N	10
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NO	ITEM	RATIONALE	STATUS	CATEGORY	F-25 COMM
1	Inspection standard for auxiliary boilers on board	01, 03 08	MASS	N/I	11
2	Inspection standard for fuel oil purifiers	01, 03 08	MASS	N/I	11
3	Inspection standard for fuel oil purifiers on board	01, 03 08	MASS	N/I	11
4	Inspection standard for heat exchangers	01, 03 08	MASS	N/I	11
5	Inspection standard for pressure gauges	01, 03 08	ANSI MASS	N/I	11
6	Inspection standard for thermometers	01, 03 08	ANSI MASS	N/I	11
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Short-term Testing/Inspection Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Inspection standard for steel pipe material	01, 03 08	ANSI ASTM ABS	N	13
2	Inspection standard for non-ferrous pipe material	01, 03 08	ANSI ASTM ABS	N	13
3	Inspection standard for plastic pipe material	01, 03 08	ANSI ASTM	N	13
4	Inspection standard for globe, angle and gate type valves	01, 03 08	MASS ANSI ISO	N	13
5	Inspection standard for relief valves	01, 03 08	MASS ANSI ISO	N	13
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Shipbuilding process & inspection standard	01, 03 08	-	H	02, 03 04, 10 11, 13
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Short-term Production Process Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Accuracy standard for access hatch covers	06 08	MASS ABS ISO	N/I	03
2	Accuracy standard for derrick booms	06 08	MASS	N/I	03
3	Accuracy standard for weathertight doors	06 08	MASS	N/I	03
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Short-term Accuracy Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Accuracy standard for pipe flanges	06 08	MASS ANSI ISO	N/I	13
2	Accuracy standard for steel pipe welding joints	06 08	MASS ANSI ISO	N/I	13
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Short-term Accuracy Standards

MID-TERM STANDARD ITEMS

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Bosun store inventory (bosun chair etc.)	04, 05 08, 09	MASS JIS	I	03
2	Derrick booms	02, 04 05, 08	MASS (ISO)	I	03
3	Goose neck brackets	02, 04 05, 08	MASS ISO	I	03
4	Topping brackets	02, 04 05, 08	MASS ISO	I	03
5	Boom rests	04, 05 08, 09	MASS JIS	I	03
6	Horn cleats	04, 05 08, 09	JIS	I	03
7	Davits and cranes for general use	04, 05 08, 09	JIS	I	03
8	Chain cable clenches	04, 05 08, 09	JIS	I	03
9	Fair leaders	04, 05 08, 09	DIN JIS	I/H	03
10	Wire reels for mooring ropes	04, 05 08, 09	JIS	I	03
11	Ladders and platforms (on exposed deck)	04, 05 08, 09	MASS	I	03
12	Ladders and platforms (in tanks, holds)	04, 05 08, 09	MASS (ISO)	I	03
13	Ladders and platforms (in engine room)	04, 05 08, 09	MASS (ISO)	I	03
14	Ladders (in accommodation)	04, 05 08, 09	MASS (ISO)	I	03
15	Ship's side ladder for pilot	02, 04 05, 08	PCC	I	03
16	Bulwark access ladders	04, 05 08, 09	(ISO) JIS	I	03
17	Doors for accommodation	04, 05 08, 09	MASS JIS	I	03

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
18	Doors for stores (non-weather/air tight door)	04, 05 08, 09	JIS	I/H	03
19	Doors for refrigerated provision chamber	04, 05 08, 09	JIS	I	03
20	Beware of propeller board	04, 05 08, 09	-	I/H	03
21	Cabin equipment	04, 05 08, 10	-	I/H	03
22	Inventories, tools	04, 05 08, 10	MASS FED MIL	I/H	03
23	Fittings for stores and work spaces (shelves etc.)	04, 05 08, 09	MASS FED	I/H	03
24	Hydrant boxes, hose boxes	04, 05 08, 09	MASS ABS	I/H	03

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Spanner for rudder stock nut	04, 05 07, 08	-	H	04
2	Spanner for pintle nuts	04, 05 07, 08	-	H	04
3	Spanner for coupling bolts and nuts	04, 05 07, 08	-	H	04
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Ventilation grills, louvers, screens, shutters	04, 05 08, 10	MARAD MASS	I	05
2	Ventilation dampers	04, 05 07, 08	MASS	I/H	05
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NO	ITEM	RATIONALE	STATUS	CATEGORY	F-25 COMM
1	Projectors and cargo lamps	04, 05 08, 10	USCG IEEE UL	I	10
2	Electric cable fitting materials	04, 05 07, 08	-	I	10
3	Electric cable glands	04, 05 07, 08	-	I	10
4	Multi-cable junction boxes	04, 05 07, 08	-	I	10
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Louver for hot air escape on funnel	04, 05 07, 08	-	H	11
2	Hatch on funnel	04, 05 07, 08	-	H	11
3	Shaft steady bearing	04, 05 07, 08	-	I	11
4	Shaft couplings	04, 05 07, 08	-	I	11
5	Spanner for shaft coupling bolts	04, 05 07, 08	-	H	11
6	Air reservoirs	04 08	MASS	I	11
7	Sampling cooler for feed water analysis test	04 08	-	H	11
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Pipe band and U-bolts	04, 05 08, 10	BV DIN JIS	I/H	13
2	Plugs and thread outlets	04, 05 08, 10	ISO JIS	I/H	13
3	Strainers and filters	04, 05 08, 09	MASS ISO	I/H	13
4	Drain scuppers	04, 05 08, 09	MASS JIS	I/H	13
5	Drain separators	04, 05 08, 09	UL	I/H	13
6	Mud boxes	04, 05 08, 09	JIS	I/H	13
7	Rose boxes and rose plates	04, 05 08, 09	JIS	I/H	13
8	Bellmouths	04, 05 08, 09	JIS	I/H	13
9	Sounding pipe heads	04, 05 08, 09	DIN JIS	I/H	13
10	Air pipe heads	04, 05 08, 09	ABS JIS	I/H	13
11	Expansion joints	04, 05 08, 09	-	I/H	13
12	Fittings for spindles for valve operation	04, 05 08, 09	JIS BV	I/H	13
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Design standard for coating by conventional paint	04 08	MASS	I	02
2	Design standard for coating by epoxy paint	04 08	MASS	I	02
3	Design standard for coating by inorganic zinc silicate paint	04 08	MASS	I	02
4	Design standard for cathodic protection	04 08	ABS	I	02
5	Design standard for impressed current cathodic protection	04 08	-	I	02
6	Application standard for coating for fittings	04 07	MASS	I	02
7	Symbols for coating	01 04	-	I	02
8	Application standard for zinc-coating for fittings	04 07	-	I	02
9	Marking method for anchor chain	01 04 06	MARAD	I	02
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Design standard for inert gas/cargo vent system	04 07	ABS	I	03
2	Design standard for fire extinguishing system	04 07	MASS ABS	I	03
3	Design standard for cargo gears	04 07	MASS ABS	I	03
4	Application standard for wires and ropes	04 08	MASS JIS	I	03
5	Design standard for anchoring (ground tackles)	04 07	-	I	03
6	Design standard for mooring system	04 07	ABS	I	03
7	Design standard for life saving appliance	04 07	MASS	I	03
8	Design standard for handrail	04 07	MASS	I	03
9	Application standard for protection cover	04 08	MASS MIL JIS	I	03
10	Design standard for access ways and ladders, etc.	04 07	MASS	I	03
11	Application standard for round scuttles, windows	04 08	MASS ABS ISO	I	03
12	Design standard for deck covering and tiling	04 08	FED	I	03
13	Design standard for joiner work	04 08	-	I	03
14	Design standard for sanitary spaces	04 08	MASS	I	03
15	Design standard for galley and pantries	04 08	MASS UL FED	I	03
16	Standard arrangement for refrigerated provision chamber	04 08	-	I	03
17	Design standard for store and workshop arrangement	04 08	MASS	I	03

NO	ITEM	RATIONALE	STATUS	CATEGORY	P-25 COMM
18	Design standard for ceiling and sparring for cargo holds	04 08	MASS	I	03
19	Design standard for fire protection in living quarters for tankers	04 07	SOLAS	I	03
20	Design standard for fire protection in living quarters for cargo ship	04 07	SOLAS	I	03
21	Design standard for insulation in living quarters	04 07	MASS	I	03
22	Standard letter size for marine use	04	-	I	03
23	Standard names for joiner cabins	01 04	MASS BV	I	03
24	Manual for indicating space names for hatches and manholes.	04 06	MASS	I	03
25	Manual for indicating safe working loads on derrick booms	04 06	ABS	I	03
26	Manual for indicating ship's name and port of registry name	04 06	MASS	I	03
27	Standard for draft marking	04 06	MASS	I	03
28	Manual for indicating pushing point mark for tug boat	04 06	MIL	I	03
29	Drawing form at fire control plan	01 04	SOLAS	I	03
30	Application standard for zinc-coating for fittings	04 08	-	I	03
31	Application standard for steel plates used for outfitting	04 08	-	I	03

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Graphic symbols for hull structure drawings	01 04	(ISO)	N	04
2	Design standard for hull structural strength against wave impacts	04 07	-	I	04
3	Application standard for built-up section for hull construction	04 08	-	H	04
4	Standard for natural frequency of structure members	04 07	-	H	04
5	Standard method of longitudinal strength calculations	04 07	ABS	I	04
6	Standard method of stability calculations	04 07	ABS	I	04
7	Application standard for edge preparation for fillet welding	04 07	MASS	I	04
8	Design standard for bilge-wells	04 08	-	H	04
9	Design standard for bilge keels	04 08	MASS	H	04
10	Drawing instructions for midship section	04	-	H	04
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Mid-term Design/Engineering Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Design standard for air conditioning system	04 08	MASS	I	05
2	Design standard for provision chamber refrigeration system	04 08	ANSI SNAME ASHRE	I	05
3	Design standard for mechanical ventilation system	04 07	MASS ABS	I	05
4	Design standard for natural ventilation system	04 07	MASS	I	05
5	Design standard for ducts and trunks	04 07	SOLAS MASS	I/H	05
6	Standard scope of supply for spares and tools for air-conditioning plant	04 08	MASS	N/I	05
7	Standard scope of supply for spares and tools for provision chamber ref. plant	04 08	MASS	N/I	05
8	Application standard for ventilators	04 07	-	H	05
9	Application standard for ventilation fans	04 07	-	H	05
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Design standard for automatic control of propulsion plant.	04 07	IEEE	I	06
2	Design standard for automatic control of electric generating plant	04 07	MASS ABS	I	06
3	Design standard for engine alarm system	04 07	ABS	I	06
4	Design standard for alarm & indication system	04 07	JIS	I	06
5	Recommended practices for electric noise suppression of automatic control instrumentation	04 07	IEEE IEC	I	06
6	Design standard for engine control room	04 07	JIS	I/H	06
7	Installation standard for sensor & detector	04 07	-	I/H	06
8	Standard method to predict reliability of automation system	04 08	-	I/H	06
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Mid-term Design/Engineering Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Standard procedures for preparation of contract plan	01 05	MASS	I/H	07
2	Standard format for specifications and purchase order sheets	01 05	ABS MASS	I/H	07
3	Standard list for submittal of drawings	01 04	ABS MASS	I/H	07
4	Standard procedures for preparation of operation manual for maneuvering	01 04	ABS. MASS ISO	I/H	07
5	Standard procedures for preparation of operation manual for loading	01 04	ABS MASS ISO	I/H	07
6	Standard procedures for preparation of operation manual	01 04	ABS MIL MASS IEEE	I/H	07
7	Design standard for stability and subdivision	01 04	ABS MASS	I	07
8	Standard of tank compartment names	01 04	-	I	07
9	Design standard for immersion mark	01 04	(ISO)	I	07
10	Design standard for name plates	04 07	-	I/H	07
11	Design standard for tonnage mark and load line	01 04	ABS	I/H	07
12	Standard procedures for preparation of spare parts and tools lists	01 04	-	I/H	07
13	Standard format of cargo gear particulars book	01 04	(ISO)	I	07
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Design standard for power system	04 07	MASS ABS IEC	I	10
2	Design standard for lighting system	04 07	MASS ABS IEC	I	10
3	Design standard for navigation and communication system	04 07	MASS ABS IEC	I	10
4	Design standard for radio system	04 07	MASS ABS IEC	I	10
5	Application standard for marine electric cables	04 08	MASS ABS IEC	I/H	10
6	Application standard for watertight cable glands	04 08	—	I/H	10
7	Design standard for main shaft driven generator system	04 07	ABS	I	10
8	Design standard for installation of highvoltage cables	04 07	IEC IEEE	I	10
9	Application standard for audio-signaling & pilot lamps inside enclosed spaces	04 08	JIS	I	10
10	Standard scope of supply for spare parts of electric equipment	02 04	ABS	N/I	10
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Design standard for machinery heat balance	04 07	MASS	I	11
2	Design standard for cooling line for diesel engines	04 07	MASS	I	11
3	Design standard for starting air line for diesel engines	04 07	ABS	I	11
4	Design standard for F.O. line for diesel engines	04 07	MASS	I	11
5	Design standard for L.O. line for diesel engines	04 07	MASS	I	11
6	Design standard for exhaust system for diesel engines	04 07	MASS	I	11
7	Design standard for supply and exhaust ventilation system for boilers	04 07	MASS	I	11
8	Design standard for control air system for machinery part	04 07	MASS	I	11
9	Design standard for feed water system for boiler	04 07	MASS	I	11
10	Design standard for L.O. line for shafting	04 07	MASS	I	11
11	Standard performance criteria for machinery	04 08	MASS	I	11
12	Design standard for stern tube bearing bush	04 08	MASS	I	11
13	Installation standard for pressure gauges	04 08	MASS	I	11
14	Installation standard for thermometers	04 08	MASS	I	11
15	Standard scope of supply for main engine spare parts and tools	02 04	MASS	N/I	11
16	Standard scope of supply for auxiliary machinery spare parts and tools	02 04	MASS	N/I	11
17	Standard scope of supply for spare parts and tools of shafting	02 04	-	N/I	11

Mid-term Design/Engineering Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Standard for welding legs for fittings	04 08	ABS	I	12
2	Design standard for welding of fittings in narrow spaces	04 07 08	-	H	12
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Design standard for steam and exhaust piping system	04 07	MASS ABS	I	13
2	Design standard for feed water piping system	04 07	MASS ABS	I	13
3	Design standard for fresh water piping system	04 07	MASS	I	13
4	Design standard for hot water piping system	04 07	MASS	I	13
5	Design standard for sea water piping system	04 07	MASS ABS	I	13
6	Design standard for bilge piping system	04 07	MASS ABS	I	13
7	Design standard for ballast piping system	04 07	MASS ABS	I	13
8	Design standard for fuel oil piping system	04 07	MASS	I	13
9	Design standard for lubricating oil piping system	04 07	MASS ABS	I	13
10	Design standard for heating coils in fuel oil tanks	04 07	MASS ABS	I	13
11	Design standard for cargo oil piping system	04 07	MASS ABS	I	13
12	Design standard for fire extinguishing piping system	04 07	MASS SOLAS ISO	I	13
13	Design standard for compressed air piping system	04 07	MASS ABS ISO	I	13
14	Design standard for air escape, overflow and sounding pipes	04 07	MASS ANSI	I	13
15	Design standard for scupper pipes	04 07	MASS	I	13
16	Design standard for soil pipes	04 07	UL	I	13
17	Design standard for hydraulic piping system	04 07	-	I	13

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
18	Design standard for tank cleaning system	04 07	MASS	I	13
19	Design standard for valve remote control system	04 07	ABS	I	13
20	Design standard for pipe insulation	04 07	MASS MIL	N/I	13
21	Design standard for distance piece fitted to hull	04 07	ABS	I/H	13
22	Application standard for special valves	04 08	-	I/H	13
23	Application standard for pipe bands and U-bolts	04 08	BV	H	13
24	Application standard for threaded outlets and plugs	04 08	-	H	13
25	Application standard for strainers and filters	04 08	-	H	13
26	Application standard for scuppers	04 08	-	H	13
27	Application standard for drain separators	04 08	-	H	13
28	Application standard for rose boxes and rose plates	04 08	-	H	13
29	Application standard for bell mouths	04 08	-	H	13
30	Application standard for sounding caps	04 08	-	H	13
31	Application standard for air pipe heads	04 08	-	H	13
32	Application standard for pipe expansion joints	04 08	-	H	13
33	Application standard for fittings of valve operating spindles	04 08	-	H	13
34	Application standard for steam traps	04 08	-	H	13

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	P-25 COMM
1	Terminology for drafting	01 04	JIS	N	93
2	Terminology for lighting	01 04	JIS	N	93
3	Terminology for welding	01 04	JIS	N	93
4	Terminology for colour	01 04	JIS	N	93
5	Terminology for sound	01 04	JIS	N	93
6	Terminology for control and automation	01 04	JIS	N	93
7	Terminology for nuclear energy	01 04	JIS	N	93
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Deck paint	01 04 08	MARAD MASS FED	N/I	02
2	Paint for shell plate	01 04 08	MARAD MASS FED	N/I	02
3	Paint for bottom plate	01 04 08	MARAD MASS FED	N/I	02
4	Paint for tanks	01 04 08	MARAD MIL	N/I	02
5	Anti-corrosive paint for general use	01 04 08	MARAD MASS FED	N/I	02
6	Preservative oil	01 04 08	MIL	N/I	02
7	Enamel	01 04 08	MARAD FED MIL	N/I	02
8	Varnish	01 04 08	FED	N/I	02
9	Preservative	01 04 08	FED	N/I	02
10	Colour chip	01 04	FED	N/I	02
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NO	ITEM	RATIO-NALE	STATUS	CATE-GORY	F-25 COMM
1	Hoist, cranes (except cargo handling)	01, 04 08	MASS	N/I	03
2	Lifts for miscallaneous use	01, 04 08	MASS	N/I	03
3	Wharf ladders	01, 04 08	JIS (ISO)	N/I	03
4	Furnitures	01, 04 08	MASS MARAD FED	N/I	03
5	Plumbing fixtures	01, 04 08	MASS	N/I	03
6	Galley equipment	01, 04 08	MASS	N/I	03
7	Hospital equipment	01, 04 08	MASS	N/I	03
8	Laundry equipment	01, 04 08	MASS	N/I	03
9	Refrigerated provision chamber equipment	01, 04 08	JIS	N/I	03
10	Clear view screen	01, 04 08	ISO	N/I	03
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Air conditioning plant	01 04 08	MASS ABS	N/I	05
2	Unit coolers	01 04 08	-	I	05
3	Fan coiled units	01 04 08	MASS	I	05
4	Convection heaters	01 04 08	MASS	I	05
5	Air filters	04 08	MASS FED MIL	I	05
6	Air washers	04 08	-	I	05
7	Propeller fans	04 08	-	I	05
8	Electric fans	04 08	-	I	05
9	Electric central air heaters	01 04 08	UL ANSI	I	05
10	Radiators	01 04 08	-	I	05
11	Axial fans	01 04 08	MARAD MASS	I	05
12	Provision chamber refrigeration plant	01 04 08	MASS ABS	N/I	05
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Gyro compass	02 04 08	IEEE (ISO)	N	06
2	Engine remote control console	01 04 08	MARAD MASS	N/I	06
3	Data logger	01 04 08	MARAD MASS	N/I	06
4	Sensors & transmitters	01 04 08	MARAD MASS	N/I	06
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Interior communication system	01, 04 08	MASS USCG ABS	N/I	10
2	Radio system	01, 04 08	MASS	N	10
3	Audible signals	01, 04 08	MASS JIS	N	10
4	Navigation light indicators	01, 04 08	JIS	N/I	10
5	Electric cable fittings (switches, receptacles, etc.)	01, 04 08	USCG ABS IEC	N/I	10
6	Ballaster for discharge lamp	01, 04 08	USCG ABS IEC	N/I	10
7	Conduit pipes for electric cables	01, 04 08	JIS	I	10
8	Distribution panels (Section board)	01, 04 08	MASS ABS IEC	N/I	10
9	Starters & control panels for motors	01, 04 08	MASS ABS IEC	N/I	10
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NO	ITEM	RATIONALE	STATUS	CATEGORY	P-25 COMM
1	Steam driven feed water pumps	01 04 08	MASS	N/I	11
2	Motor driven gear pumps	01 04 08	MASS	N/I	11
3	Motor driven centrifugal pumps	01 04 08	MASS	N/I	11
4	Motor driven reciprocating pumps	01 04 08	MASS	N/I	11
5	Forced draft fans	01 04 08	MASS	N/I	11
6	Steam separators	01 04 08	MASS	N/I	11
7	Distilling plant	01 04 08	MASS	N/I	11
8	Exhaust gas economizers	01 04 08	MASS	N/I	11
9	Generator engines	01 04 08	MASS	N/I	11
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Hose valves	01, 04 08	DIN JIS	N/I	13
2	Pressure reducing valves	01, 04 08	MIL	N/I	13
3	Motor driven valves	01, 04 08	-	I	13
4	Solenoid valves	01, 04 08	-	I	13
5	Butterfly valves	01, 04 08	MASS	N/I	13
6	Flow meters	01, 04 08	-	I	13
7	Emergency shut-off valves	01, 04 08	-	I	13
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Inspection standard for surface preparation	03 08	ASTM SSPC	I/H	02
2	Inspection standard for paint film thickness	03 08	ASTM	I/H	02
3	Inspection standard for bottom paint of steel vessels	03 08	JIS	I	02
4	Standard for performance test for varnish	03 08	JIS	I	02
5	Standard for performance test for enamel	03 08	JIS	I	02
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Mid-term Testing/Inspection Standards.

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Inspection standard for hose test of weather tight cover	01, 03 08	MASS ABS	I	03
2	Inspection standard for operation of cargo hatch covers on board	03 08	-	H	03
3	Inspection standard for fire extinguishing system on board	01, 03 08	MASS ABS	N	03
4	Inspection standard for cargo gears on board	01, 03 08	MASS ABS	I	03
5	Inspection standard for derrick booms	01, 03 08	MASS	I	03
6	Inspection standard for goose neck brackets, topping brackets	01, 03 08	MASS	I	03
7	Inspection standard for inert gas/vent system on board	01, 03 08	ABS	N	03
8	Inspection standard for steering gear	01, 03 08	MASS ABS	N	03
9	Inspection standard for hoists/cranes (except cargo handling)	01, 03 08	MASS	I	03
10	Inspection standard for operation of launching equipment for life boats on board	01, 03 08	MASS	N	03
11	Inspection standard for operation of ship's side ladders on board	03 08	-	H	03
12	Inspection standard for furnitures	01, 03 08	MASS MARAD FED	I	03
13	Inspection standard for plumbing fixtures	01, 03 08	MASS	I	03
14	Inspection standard for galley equipment	01, 03 08	MASS UL FED	I	03
15	Inspection standard for hospital equipment	01, 03 08	MASS	I	03
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Inspection standard for rudder	03 08	-	I/H	04
2	Inspection standard for rudder stock	03 08	-	I/H	04
3	Inspection standard for rudder pintles	03 08	-	I/H	04
4	Inspection standard for stern frame	03 08	-	I/H	04
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Inspection standard for air conditioning plant	03 08	-	I/H	05
2	Inspection standard for refrigerating machine	01, 03 08	ABS ISO	I	05
3	Inspection standard for fans	01, 03 08	AMCA	I	05
4	Inspection standard for air conditioning system on board	01, 03 08	ISO	I	05
5	Inspection standard for provision refrigerating system on board	01, 03 08	ABS ISO	N/I	05
6	Inspection standard for mechanical ventilation system on board	03 08	ABS	I/H	05
7	Inspection standard for thermo tank	03 08	-	I/H	05
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	General rules for environment inspections of control & instrumentation equipment	01, 03 08	IEC	I	06
2	Inspection standard for sensors & transmitters for machinery space on board	01, 03 08	-	I	06
3	Inspection standard for control & instrumentation equipment on board	01, 03 08	MASS ABS	I	06
4	Standard method of electrical noise measurement on board	01, 03 08	IEEE MIL	I	06
5	Inspection standard for engine control system	01, 03 08	-	I/E	06
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	General requirements for tolerance in testing	01, 03 08	ISO	N/I	07
2	General requirements for inspection sampling	01, 03 08	MIL ABS	N/I	07
3	Standard conditions for testing	01, 03 08	ASTM ISO	N/I	07
4	Standard method of noise measurement	01, 03 08	ASTM MIL ISO	N/I	07
5	Standard method of vibration measurement	01, 03 08	MIL ASTM	N/I	07
6	Standard method of inclination test	01, 03 08	ABS	N/I	07
7	Standard method of tests and trials	01, 03 08	MASS ABS	N/I	07
8	Standard method of noise measurement on board	01, 03 08	IMCO ISO	N/I	07
9	Standard method of vibration measurement on board	01, 03 08	—	N/I	07
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Mid-term Testing/Inspection Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Inpsection standard for windlass on board	01, 03 08	SNAME	M/I	08
2	Inspection standard for mooring winches on board	01, 03 08	ISO	M/I	08
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Inspection standard of electric installation on board	03 08	ABS IEC	I/H	10
2	Inspection standard of electric systems on board	03 08	ABS IEC	I/H	10
3	Standard of quality control for electric systems on board	03 08	-	I/H	10
4	Inspection standard of electric equipment	03 08	-	I/H	10
5	Inspection standard of generator	01, 03 08	MASS ABS IEC	I/H	10
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Mid-term Testing/Inspection Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Inspection standard of main diesel engine	01, 03 08	MASS JIS	I	11
2	Inspection standard of main diesel engine on board	01, 03 08	MASS	I	11
3	Inspection standard of propeller	01, 03 08	MASS	I	11
4	Inspection standard of engine for generator	01, 03 08	MASS	I	11
5	Inspection standard of generator on board	01, 03 08	MASS	I	11
6	Inspection standard of exhaust gas economizer	03 08	MASS	I	11
7	Inspection standard of exhaust gas economizer on board	03 08	MASS	I	11
8	Inspection standard of shafting	01, 03 08	MASS	I	11
9	Inspection standard of shafting steady bearing	01, 03 08	MASS	I	11
10	Inspection standard of stern tube bush	01, 03 08	MASS	I	11
11	Inspection standard of air reservoirs	01, 03 08	MASS	I	11
12	Inspection standard of air compressor	01, 03 08	MASS	I	11
13	Inspection standard of air compressor on board	01, 03 08	MASS	I	11
14	Inspection standard of pump	01, 03 08	MASS	I	11
15	Inspection standard of fan	01, 03 08	MASS	I	11
16	Inspection standard of steam separator	03 08	MASS	I	11
17	Inspection standard of distilling plant on board	03 08	MASS	I	11

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Standard method of nondestructive inspection for welding part	01, 03 08	ABS ASTM	N/I	12
2	Standard method of ultrasonic inspection for welding part	01, 03 08	ABS JIS	N/I	12
3	Standard method of radiographic inspection for welding part	01, 03 08	ISO ABS JIS	N/I	12
4	Standard method of tensile and fatigue test for welding part	01, 03 08	ABS	N/I	12
5	Inspection standard of heat treatment for welding part	01, 03 08	ABS JIS	N/I	12
6	Standard method of tensile test for welding joint	01, 03 08	ABS JIS	N/I	12
7	Standard method of bend test for welding joint	01, 03 08	ABS JIS	N/I	12
8	Inspection standard of seam welding	01, 03 08	JIS	N/I	12
9	Standard method of cracking test for welding part	01, 03 08	JIS	N/I	12
10	Standard of torelance for welding	01, 03 08	ISO	N/I	12
11	Standard method of corrosion test for cladding	01, 03 08	ABS JIS	N/I	12
12	Standard method of tensile test for cladding	01, 03 08	ABS JIS	N/I	12
13	Standard method of impact test for cladding	01, 03 08	ABS JIS	N/I	12
14	Standard method of qualification test for welding	03 07	ABS JIS	N/I	12
15	Standard method of qualification test for brazing	03 07	JIS	N/I	12
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Mid-term Testing/Inspection Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Hose valve	01 03 08	-	I	13
2	Inspection standard of control valve	01 03 08	MIL	I	13
3	Inspection standard of motor valve	01 03 08	-	I	13
4	Inspection standard of solenoid valve	01 03 08	-	I	13
5	Inspection standard of butterfly valve	01 03 08	MASS	I	13
6	Inspection standard of flow meter	01 03 08	-	I	13
7	Inspection standard of emergency shut-off valve	01 03 08	-	I	13
8	Inspection standard of strainer and filter	01 03 08	MASS ISO	I	13
9	Inspection standard of expansion joint	01 03 08	-	I	13
10	Inspection standard of steam and exhaust piping system on board	03 08	MASS ABS	I/H	13
11	Inspection standard of feed water piping system on board	03 08	MASS ABS	I/H	13
12	Inspection standard of fresh water piping system on board	03 08	MASS	I/H	13
13	Inspection standard of hot water piping system on board	03 08	MASS	I/H	13
14	Inspection standard of sea water piping system on board	03 08	MASS ABS	I/H	13
15	Inspection standard of bilge piping system on board	03 08	MASS ABS	I/H	13
16	Inspection standard of ballast water piping system on board	03 08	MASS ABS	I/H	13
17	Inspection standard of fuel oil piping system on board	03 08	MASS	I/H	13

Mid-term Testing/Inspection Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
18	Inspection standard of lubricating oil piping system on board	03 08	MASS ABS	I/H	13
19	Inspection standard of heating coil in oil tank on board	03 08	MASS ABS	I/H	13
20	Inspection standard of cargo oil piping system on board	03 08	MASS ABS	I/H	13
21	Inspection standard of fire extinguishing piping system on board	03 08	MASS SOLAS	N/I	13
22	Inspection standard of compressed air piping system on board	03 08	MASS ABS ISO	I/H	13
23	Inspection standard of hydraulic piping system on board	03 08	-	I/H	13
24	Inspection standard of tank cleaning system on board	03 08	-	I/H	13
25	Inspection standard of valve remote control system on board	03 08	-	I/H	13
26	Inspection standard of tank level indicating system on board	03 08	MASS	I/H	13

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Work process standard of casting	06 08	JIS	I/H	01
2	Work process standard of surface treatment	06 08	JIS	I/H	01
3	Work process standard of heat treatment for steel	06 08	JIS	I/H	01
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Mid-term Production Process Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Work process standard for installation of cargo hatch cover	06 08	MASS ABS	H	03
2	Work process standard for installation of steering gear	06 08	MASS ABS	H	03
3	Work process standard for installation of anchor chain controller	06 08	MASS	H	03
4	Work process standard for fitting of chocks, fairleaders	06 08	PCC	H	03
5	Work process standard for fitting of round scuttles, windows	06 08	MASS ABS	H	03
6	Work process standard for fitting of ceiling in accommodation quarters	06 08	MASS	H	03
7	Work process standard for deck covering and tiling	06 08	FED MIL	H	03
8	Work process standard for insulation in accommodation quarters	06 08	MASS	H	03
9	Work process standard for applying of fire protection and insulation material	06 08	SOLAS	H	03
10	Work process standard for provision refrigerating chamber	06 08	-	H	03
11	Work process standard for ceiling and sparring in cargo holds	06 08	MASS ABS	H	03
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Work process standard for assembly of hull structure	06 08	-	H	04
2	Work process standard for fitting of hatch coamings	06 08	-	H	04
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Work process standard for installation of windlass	06 08	SNAME	H	08
2	Work process standard for installation of mooring winch	06 08	ISO	H	08
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Work process standard for electric installation in fire protection divisions	06 08	ABS IMCO	I/H	10
2	Work process standard for electric installation in hazardous zones	06 08	ABS USCG IEC	I/H	10
3	Work process standard for earthing of non-carring parts of electric cables & equipment	06 08	ABS USCG IEC	I/H	10
4	Work process standard for installation of electric cables and equipment	06 08	ABS	I/H	10
5	Work process standard for installation of interior communication/nautical system	06 08	ABS	I/H	10
6	Work process standard for installation of temp./press. detector system	06 08	ABS	I/H	10
7	Work process standard for installation of electric lighting & signal light	01 06 08	-	H	10
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Work process standard for installation of main engine	06 08	MASS	I/H	11
2	Work process standard for installation of auxiliary machinery	06 08	MASS	I/H	11
3	Work process standard for installation of boiler	06 08	MASS	I/H	11
4	Work process standard for installation of shafting	06 08	MASS	I/H	11
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Mid-term Production Process Standards

NO	ITEM	RATIONALE	STATUS	CATEGORY	F-25 COMM
1	Definition of welding performance	06	ISO	N	12
2	Definition of welding process	06	ISO	N	12
3	Definition of welding posture	06	ISO JIS	N	12
4	Application standard of welding rod	06 08	ABS MIL JIS	N/I	12
5	Application standard of brazing material	06 08	JIS	N/I	12
6	Qualification of welder	06 08	ABS ASTM	N/I	12
7	Standard for safety and control of radiographic inspection	06	-	N	12
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Mid-term Production Process Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Work process standard for assembly for pipes	06 08	-	H	13
2	Work process standard for pipe bending	06 08	-	H	13
3	Work process standard for assembly of pipe joints	06 08	-	H	13
4	Work process standard for assembly of pipe flanges	06 08	-	H	13
5	Work process standard for flushing of piping systems on board	06 08	-	H	13
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Mid-term Production Process Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Accuracy standard of hatch cover	06 08	MASS ABS	N/I	03
2	Accuracy standard of rudder carrier	06 08	MASS	N/I	03
3	Accuracy standard of joiner door	06 08	MASS	N/I	03
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Mid-term Accuracy Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Accuracy standard of principal hull dimensions	06 08	-	N/I	04
2	Accuracy standard for deformation of hull form	06 08	-	N/I	04
3	Accuracy standard for dimensions of sub-assembly	06 08	-	I/H	04
4	Accuracy standard of curved shell plate	06 08	-	I/H	04
5	Accuracy standard for fabrication of hull structural member	06 08	-	I/H	04
6	Accuracy standard for alignment and finishing	06 08	-	I/H	04
7	Accuracy standard for dimension of gas cutting	06 08	-	I/H	04
8	Accuracy standard for welding bead of hull structure	06 08	MASS	I/H	04
9	Accuracy standard of rivet and rivet hole	06 08	-	I/H	04
10	Accuracy standard of hatch coaming	06 08	-	I/H	04
11	Accuracy standard of opening	06 08	-	I/H	04
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Mid-term Accuracy Standards

NO	ITEM	RATIONALE	STATUS	CATEGORY	F-25 COMM
1	Accuracy standard of shaft alignment	06 08	MASS	I/H	11
2	Accuracy standard of stern tube bush	06 08	MASS	I/H	11
3	Accuracy standard of intermediate shaft bearing	06 08	MASS	I/H	11
4	Accuracy standard of propeller shaft	06 08	MASS	I/H	11
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Mid-term Accuracy Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Accuracy standard for assembly of piping	06 08	-	I/H	13
2	Accuracy standard for pipe bending	06 08	-	I/H	13
3	Accuracy standard for assembly of butt welding joint	06 08	-	I/H	13
4	Accuracy standard for fitting angle of pipe flanges	06 08	-	I/H	13
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Mid-term Accuracy Standards

LONG-TERM STANDARD ITEMS

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Water tight door	02, 04 05, 08	ABS JIS	N/I	03
2	Securing device for cargo hatch cover	04, 05 08, 09	MASS ABS	I/H	03
3	Mast, Derrick post	04, 05 07, 08	MASS ABS	H	03
4	Ventriser (cargo/inert gas vent)	04, 05 08, 09	ABS	N/I	03
5	Pressure vacuum breaker	04, 05 08, 09	ABS	I	03
6	Container lashing device	04, 05 08, 09	ABS	I/H	03
7	Independent tank (miscellaneous use)	04, 05 08, 09	-	I/H	03
8	Seats for fitting and equipment	04, 05 07, 08	-	H	03
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	P-25 COMM
1	Air inlet and outlet pieces	04, 05 07, 08	MASS	H	05
2	Duct and accessories	04, 05 07, 08	MASS	H	05
3	Canopy	04, 05 07, 08	-	H	05
4	Air hatch cover	04, 05 07, 08	-	H	05
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Antenna post	04, 05 07, 08	-	H	10
2	Seats for electric equipment	04, 05 07, 08	-	H	10
3	Protection cover for electric fittings and cables	04, 05 07, 08	-	H	10
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	P-25 COMM
1	Seat of fuel oil valve test pump, etc. for main diesel engine	04, 05 07, 08	-	H	11
2	Cleaning table of purifier, etc.	04, 05 07, 08	-	H	11
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Pipe penetration piece	04, 05 08, 09	JIS BV	I/H	13
2	Pipe support	04, 05 08, 09	MASS	H	13
3	Independent storage tank for fuel oil, lubricating oil, cooling water etc.	04, 05 08, 09	MASS	H	13
4	Sea chest grating	04, 05 08, 09	ABS	H	13
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NO	ITEM	RATIONALE	STATUS	CATEGORY	F-25 COMM
1	Design standard of steering system	04 07	MASS ABS	I	03
2	Design standard of bow thruster	04 08	MASS	I	03
3	Design standard of container stowage and handling	04 07	ABS	I	03
4	Design standard of lumber handling and lashing	04 08	-	I	03
5	Design standard of heavy cargo handling and lashing	04 08	-	I	03
6	Application standard of gasket	04 08	-	I	03
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Long-term Design/Engineering Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Design standard of shell construction	04 08	ABS	H	04
2	Design standard of forward hull construction	04 08	ABS	H	04
3	Design standard of aftward hull construction	04 08	ABS	H	04
4	Design standard of bottom construction for single hull	04 08	ABS	H	04
5	Design standard of double bottom construction	04 08	MASS ABS	H	04
6	Design standard of watertight bulkhead	04 08	MASS ABS	H	04
7	Design standard of deep tank bulkhead	04 08	MASS ABS	H	04
8	Design standard of swash bulkhead	04 08	MASS ABS	H	04
9	Design standard of compensation for bulkhead opening	04 08	ABS	H	04
10	Design standard of upper deck construction	04 08	MASS ABS	H	04
11	Design standard of round gunwale and shell top	04 08	ABS	H	04
12	Design standard of compensation for upper deck opening	04 08	ABS	H	04
13	Design standard of machinery space construction	04 08	ABS	H	04
14	Design standard of pump room construction	04 08	ABS	H	04
15	Design standard of bulwark construction	04 08	ABS	H	04
16	Design standard of companion construction	04 08	-	H	04
17	Design standard of winch house construction	04 08	-	H	04

NO	ITEM	RATIO-NALE	STATUS	CATE-GORY	F-25 COMM
18	Design standard of deck store construction	04 08	-	H	04
19	Design standard of top side tank construction	04 08	ABS	H	04
20	Design standard of hatch coaming	04 08	MASS ABS	H	04
21	Design standard of chain locker	04 08	MASS ABS	H	04
22	Design standard of pillar and stanchion	04 08	MASS ABS	H	04
23	Design standard of vent trunk fitted on hull construction	04 08	MASS ABS	H	04
24	Design standard of superstructure construction	04 08	ABS	H	04
25	Design standard of wind reflector	04 08	-	H	04
26	Design standard of air guide plate for smoke prevention	04 08	-	H	04
27	Design standard of rudder and rudder stock	04 08	MASS ABS	H	04
28	Design standard of stern frame	04 08	ABS	H	04
29	Standard method for prediction and control of hull vibration	04 07	-	I	04
30	Standard method of fatigue strength calculation	04 07	-	I	04

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Design standard of cargo hold refrigeration system	04 08	ANSI MASS ASHRE	I	05
2	Design standard of cargo hold dehumidification system	04 08	MASS	I	05
3	Standard method of temperature control for air-con system	04 08	MASS	I	05
4	Standard method of temperature control for refrigeration system	04 08	MASS	I	05
5	Design standard of alarm system for refrigerated provision chamber	04 08	IEEE	I	05
6	Installation standard of electric central heater	04 07	UL	H	05
7	Installation standard of air-washer and air-filter	04 07	-	H	05
8	Application standard of ventilator head	04 07	-	H	05
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Long-term Design/Engineering Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Design standard of control & instrumentation system	04 07	MASS ABS IEC	I/H	06
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Design standard of contamination and pollution control	02 04	MIL USCG OCIMF	N	07
2	Design criteria of sound level on board vessel	02 04	IMCO MASS MIL	N	07
3	Design criteria of vibration level on board vessel	02 04	MASS ABS	N	07
4	Design standard of noise control on board vessel	04 07	IMCO	N	07
5	Design standard of fire prevention and safety requirement	04 07	ABS NFPA ANSI IMCO SOLAS	N	07
6	Design procedure for previously built ship	04	MASS	H	07
7	Application standard of microfilm	04	ABS MIL MASS	H	07
8	Standard procedure for development and control of computer programs	04	-	H	07
9	Application standard of computer program	04	-	H	07
10	Standard procedure for computer data control	04	-	H	07
11	Drawing format of key plan	04	MIL ABS	I/H	07
12	Drawing format of yard plan	04 06	MIL ABS	I/H	07
13	Standard procedure for drafting of docking plan	04	-	H	07
14	Standard procedure for material control	05 06	-	H	07
15	Standard procedure for purchasing material	05 06	-	H	07
16	General requirement of reliability program	04 08	MIL ABS	I/H	07
17	General requirement of quality assurance	04 08	MIL	I/H	07

Long-term Design/Engineering Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Design standard of propeller overhaul device	04 07	-	H	11
2	Design standard of stack	04 08	MASS	H	11
3	Installation standard of incinerator for disused oil	04 07	-	I/H	11
4	Design standard of crude oil burning device for boiler	04 07	ABS	I/H	11
5	Design standard of pollution abatement system and equipment for stack emission	04 07	MASS	I/H	11
6	Design standard of supply and exhaust ventilation system for emergency generator	04 07	MASS	I/H	11
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Symbols of piping insulation	04 06	-	H	13
2	Guidance for numbering of pipe fitting	04 06	-	H	13
3	Numbering system for pipe fitting	04 06	-	H	13
4	Sub-code of piece-drawing for piping	04 06	-	H	13
5	Numbering system of piping	04 06	-	H	13
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Terminology of quality control	01 04	JIS	N	93
2	Terminology of test and inspection	01 04	JIS	N	93
3	Terminology of reliability and maintenability	01 04	MIL JIS	N	93
4	Terminology of safety	01 04	-	N	93
5	Terminology of material control	01 04	-	N	93
6	Terminology of corrosion control	01 04	-	N	93
7	Terminology of painting	01 04	-	N	93
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Solvent for marine use	01, 04 08	-	I	02
2	Enamel for marine use	01, 04 08	-	I	02
3	Anode	01, 04 08	-	I	02
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Side port	04 08	MASS	I	03
2	Cargo hatch cover	04 08	MASS ABS	I	03
3	Foundation for machinery	04 08	ABS	H	03
4	Steering gear	01, 04 08	MASS ABS SOLAS	N/I	03
5	Rudder carrier	04 08	MASS ABS	I/H	03
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Cargo hold refrigeration plant	01 04 08	MASS ABS	I	05
2	Cargo hold dehumidification plant	01 04 08	MASS	I	05
3	Ice cube maker	01 04 08	MASS	I	05
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NO	ITEM	RATIO-NALE	STATUS	CATE-GORY	F-25 COMM
1	Deck crane	01 04 08	ABS	I	08
2	Elevator	04 08	UL ABS	I/H	08
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Main diesel engine	01 04 08	MASS	I	11
2	Propeller	01 04 08	MASS	I	11
3	Analysis equipment for boiler feed water and exhaust gas	01 04 08	MASS	I	11
4	Incinerator of disused oil	04 08	-	I/H	11
5	Exciter	04 08	ABS	H	11
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NO	ITEM	RATIO-NALE	STATUS	CATE-GORY	F-25 COM
1	Steam trap	01 04 08	FCI	I	13
2	Special valves	01 04 08	-	I	13
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Inspection standard of bow thruster	01, 03 08	MASS	I	03
2	Inspection standard of special equipment	03 08	-	H	03
3	Standard method of sea trial and test for hull part	01, 03 08	-	I	03
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Inspection standard of airtightness for hull construction	03 08	ABS	I/H	04
2	Inspection standard of watertightness for hull construction	03 08	ABS	I/H	04
3	Standard method of measurement for local vibration	03 08	-	H	04
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Inspection standard of cargo hold refrigeration system on board	01 03	ABS ISO MASS	I	05
2	Standard method of noise measurement for fan	01 03	AMCA	I	05
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	General requirement of calibration for meter	03 08	MIL	N/I	07
2	General requirement of certification for meter	03 08	ASTM	N/I	07
3	General requirement of certification for vessel	03 08	ABS MASS	N	07
4	Standard of underwater inspection in lieu of drydocking survey	01 03	ABS	I	07
5	General requirement of model test	03 08	MASS ABS	I/H	07
6	General requirement of workshop test	01 03	MASS SNAME	I/H	07
7	Standard method of environmental test	01 03	MIL	N/I	07
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Inspection standard of deck crane	01, 03 08	ABS	I	08
2	Inspection standard of deck crane on board	01, 03 08	ABS	I	08
3	Inspection standard of elevator	03 08	UL ABS	I	08
4	Inspection standard of elevator on board	03 08	UL ABS	I	08
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COM
1	Inspection standard of incinerator for disused oil on board	03 08	-	I/H	11
2	Standard method of sea trial and test for machinery part	01, 03 08	-	I/H	11
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Work process standard for surface preparation of coating	06 08	MASS FED SSPC	H	02
2	Work process standard for coating	06 08	MASS MIL DOD	H	02
3	Work process standard for zinc-coating	06 08	ASTM	H	02
4	Work process standard for putty-work	06 08	MARAD	H	02
5	Work process standard for fitting of anodes	06 08	-	H	02
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Long-term Production Process Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Work process standard for installation of container stowage and lashing equipment	06 08	ABS	H	03
2	Work process standard for leveling and adjusting of contact surface	06 08	-	H	03
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Work process standard for installation of deck cranes	06 08	ABS	H	08
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Work process standard for installation of electric equipment	06 08	-	H	10
2	Work process standard for fitting water tight cable glands of electric equipment	06 08	-	H	10
3	Work process standard for earthing of electric equipment	06 08	-	H	10
4	Work process standard for operation and adjustment of electric equipment	06 08	-	H	10
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Work process standard for fitting stern bush	06 08	-	H	11
2	Work process standard for preparation of shaft coupling bolt	06 08	-	H	11
3	Work process standard for repairing propeller defects by welding	06 08	ABS	I/H	11
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Long-term Production Process Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Application standard of welding machine	06 08	-	H	12
2	Work process standard for welding	06 08	MIL	I/H	12
3	Work process standard for brazing	06 08	-	H	12
4	Application standard of welding method	06 08	-	H	12
5	Work process standard for stress relief after welding	06 08	JIS	I/H	12
6	Work process standard for heat treatment after welding	06 08	ABS	I/H	12
7	Standard control parameter for welding	06 08	-	H	12
8	Work process standard for corrosion control of welded parts	06 08	ABS	I/H	12
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Work process standard for assembly of non-ferrous pipe	06 08	-	H	13
2	Work process standard for piping insulation	06 08	-	H	13
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NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Accuracy standard for positioning of equipment	06 08	-	H	03
2	Accuracy standard for side port	06 08	MASS	I/H	03
3	Accuracy standard for container stowage and lashing equipment	06 08	ABS	I/H	03
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Long-term Accuracy Standards

NO	ITEM	RATIO -NALE	STATUS	CATE -GORY	F-25 COMM
1	Accuracy standard for laying deck crane rails	06 08	ABS	I/H	08
2	Accuracy standard for installation of elevator	06 08	ABS U1	I/H	08
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Long-term Accuracy Standards

RECOMMENDED
U. S. SHIPBUILDING STAMMRDS PROGRAM

LONG-RANGE PLAN

VOLUME II

APPENDIX II-c

CONTENTS OF STADARDS DOCUMENTATION

APPENDIX II-C
CONTENTS OF STANDARDS DOCUMENTATION

The deecriptions that shold be contained in standards documentation are as follows:

1. SCOPE OF APPLICATION

The characteristics of the standard should be clearly described together with the standard's name, including the following.

1) Scope of application
2) Extent and/or conditions of usage
3) Usage excluded
4) Standards referred
5) Other necessary remarks

2. STANDARDS FEATUEES

The standard's structure, shape, size, dimenaiona, material. functional Performance, rnanufacmring methods,usage, etc. should defined to describe its features. These description will be comprehensible by listing them in a Table, using symbols (e.g. alphabets, numerals) to define their grade or class.

The following is an example of the Table:

Features	Method of description	Example
Structure, shape,	..... type	Watertight, Round type.
Size, dimensions,	(indicate measures)	A x B x C
Material,	(name, grade)	Cast iron, Grade A.
Characters,	(physical characteristics)	Hard. fire-proof.
Appearance, mode,	..... mode	Liquid
Manufacturing method,	..... method	A Method
purpose,	For (use)	Transfor of *water*.
Starting method,	..... method	Manual
System,	..... system	Fuel system.

3. EXPLANATIONS

To provide a clear understanding of the background to the users of the standard, it is advisable to add sections to the document describing how the standard had been developed This explanation will also facilitate identification of the logic when any revision is required in the future.

The explanations should inciude the following notes

1) The objective of the
   i) Necessity of the standard
   ii) Boundary condition, etc.

2)procese of development
   i) Date of development and issuer of the standard
   ii) Name of developer or drafter and the date the draft wasiisued
   iii) Name of the *organization which evaluated the draft* and the date when the evaluation was completed
   iv) The date the standard wee issued or enacted

3) Technical back data:

Technical back data and calculations that constitute the standard, and basic conditions to attain the standard's objective.

4) Rational of revision:

The rationale of revision, its contents, date of revision.

4. REFERENCES

Examples of JIS standard documentation are attached for reference.

F 2001-1979

Bollards

1. Scope

This Japanese Industrial Standard specifies bollards for ship use.

Remarks: In this standard, the units and numerical values in [ ] are in accordance with the International System of Units (SI), and given for reference only.

2. Construction, Shape and Dimensions

The construction, shape and dimensions shall conform to Figure and also to the following requirements:

(1) The height of bedplate h is the minimum required. In the case of fitting the bollard directly on the steel deck under planking, however, the top of bedplate shall be elevated above the deck plank by at least 15 mm.

(2) The diameter of applicable rope gives for reference the maximum size of rope the strength of bollard can permit.

(3) The fins for the convenience of rope handling may be fitted as specified by the orderer.

3. Appearance

The bollard shall, in appearance, be free from defects such as crack, flaw detrimental to service or use, and of good finish.

4. Materials

The materials shall conform to Table 1.

Table 1

No.	Component	Material
1	Foot	JIS G 3106-SM 41, JIS G 3101-SS 41, JIS G 3454-STPG 38 or STPG 42, or JIS G 3456-STPT 38 or STPT 42
2	Bedplate	JIS G 3106-SM 41 or JIS G 3101-SS41

5. Appearance Inspection

The bollard shall be visually inspected for appearance, and shall conform to the requirements of 3.

6. Designation of Product

The bollard shall be designated by the title and nominal diameter (affixed with N for fins, if fitted). JIS number may be used in place of the title.

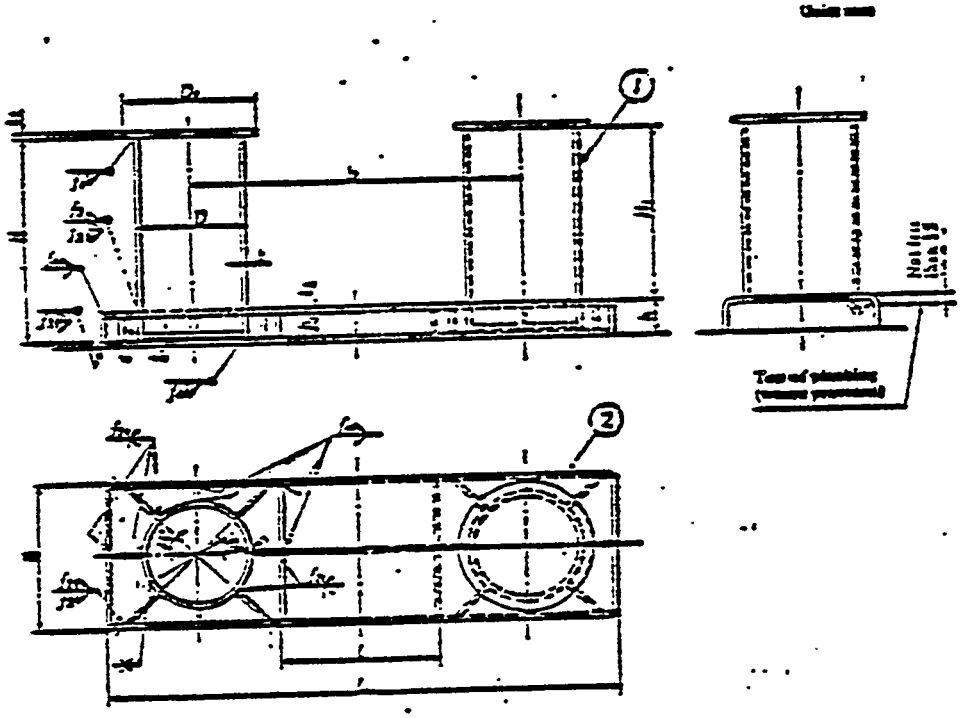
Examples: Bollard 100 or JIS F 2001-100
Bollard 100 N or JIS F 2001-100 N

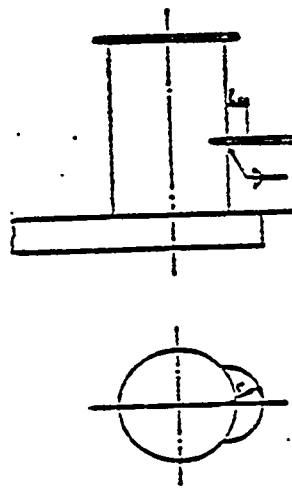
Reference Standards:

JIS G 3101 — Rolled Steel for General Structure
JIS G 3106 — Rolled Steels for Welded Structure
JIS G 3454 — Carbon Steel Pipes for Pressure Service
JIS G 3456 — Carbon Steel Pipes for High Temperature Service
JIS G 3525 — Wire Rope
JIS L 2701 — Hard and Bast Fibre Ropes

Related Standards:

JIS G 3193 — Dimensions, Weight and Permissible Variations of Hot Rolled Steel Plates, Sheets and Strip





Figure

Units mm

Nominal diameter	Foot												
	D	D_1	H	H_1	Min. l	Min. l_1	l_2	h_2	e	b	h_3	l_3	r
100	114.3	145	196	150	18	6	7	40	6	250	–	–	–
125	139.8	180	246	190	18	6	8	50	6	315	–	–	–
160	165.2	210	316	250	10	6	9	60	8	400	–	–	–
200	216.3	270	378	300	10	8	9	70	8	500	–	–	–
250	267.4	330	470	380	11	10	9	80	8	630	190	60	80
315	318.5	385	597	480	15	12	9	105	10	800	205	70	105
355	355.6	425	663	530	17	13	12	120	10	890	230	80	120
400	406.4	485	749	600	18	14	12	135	10	1000	255	90	140
450	457.2	550	841	680	19	16	12	145	10	1130	275	100	160
500	508.0	610	928	750	20	18	12	160	12	1250	290	100	180
560	558.8	670	1025	830	22	20	12	175	12	1380	315	110	200
630	609.6	730	1152	940	24	22	12	190	12	1570	330	110	225
710	711.2	840	1294	1050	25	24	12	220	14	1750	350	120	255
800	812.8	940	1480	1200	26	25	12	255	14	2000	370	120	255

Nominal diameter	Seat plate						
	S	L	Min. h	Min. t_1	l	R	Rib
100	165	445	50	6	78	15	6 x 40
125	195	540	60	6	100	15	6 x 50
160	225	670	70	6	145	20	6 x 60
200	290	860	85	8	160	25	8 x 70
250	360	1065	100	10	215	30	10 x 80
315	430	1300	125	12	325	35	12 x 105
355	480	1475	145	13	360	40	13 x 120
400	550	1630	160	14	400	45	14 x 135
450	620	1840	170	16	450	50	16 x 145
500	690	2040	190	18	500	55	18 x 160
560	750	2240	210	20	560	60	20 x 175
630	820	2510	225	22	630	70	22 x 190
710	960	2840	260	24	710	80	24 x 220
800	1100	3240	295	25	810	80	25 x 255

Figure (continued)

Unit: mm

Nominal diameter	Lay of rope					Reference Calculated mass (kg)	Min. breaking load of representative rope P (kN) {kgf}
	f_6	f_6	f_6	f_6	f_6		
100	4	2	4	4	6	18.9	3(29]
125	4	2	4	4	6	29.6	4(39]
160	4	2	4	4	6	44.7	5[49]
200	4	3	6	6	8	79.5	8[78]
250	6	4	8	6	10	139	12 [118]
315	6	5	10	8	12	251	20 [196]
355	8	5	10	8	13	361	26 [255]
400	8	6	10	8	14	502	32 [314]
450	8	7	12	8	16	686	39 [382]
500	8	8	12	10	16	911	46 [451]
560	8	8	14	10	16	1220	56 [549]
630	8	9	14	10	16	1686	70 [686]
710	8	10	16	12	16	2252	82 [804]
800	8	10	16	12	16	3071	100 [981]

Nominal diameter	Diameter of applicable rope (reference)					
	Wire rope				Hemp rope	Synthetic fiber rope
	No. 2 (6 × 12)	No. 4 (6 × 24)	No. 5 (6 × 30)	No. 6 (6 × 37)		
100	9	8	8	6.3	20	16
125	10	9	9	8	24	18
160	12.5	10	10	10	28	22
200	14	12.5	12.5	12.5	36	26
250	18	16	16	14	42	38
315	22.4	20	20	20	55	39
355	25	22.4	22.4	22.4	65	45
400	30	25	25	25	75	52
450	33.5	28	28	28	85	56
500	35.5	31.5	31.5	30	90	64
560	40	33.5	35.5	33.5	100	70
630	–	37.5	40	35.5	110	77
710	–	40	42.5	40	120	84
800	–	45	47.5	42.5	–	–

Remarks 1. Where the vertical weld joins of pass is one, the weld shall be situated lowest of the two parts.

2. Calculated mass is given for steel dank without plumbing.

3. Wire ropes conform to JIS G 3525, hemp ropes to JIS L 2701, and synthetic fiber ropes to three or eight strand ropes approved by Nippon Kaiji Kyokai.

Figure (omission)

F 8003-1975

General Requirements for Construction of Electric Lighting Fittings (Incandescent Lamps) for Marine Use

1. Scope

This Japanese Industrial Standard specifies general requirements for construction of marine electric lighting fittings (hereinafter referred to as "fittings"), the light source of which is incandescent lamp conform to this standard.

Note (1): "Fittings for special use" means flame-proof lighting fittings and the like.

Remarks: In this standard units and numerical values in [ ] are in accordance with the International System of Units (SI), and given for reference only.

2. Definitions

2.1 Corrosion-Resistant Materials The corrosion-resistant materials are mainly as follows:

Copper, brass, bronze, nickel copper alloy, beryllium copper, nickel copper zinc alloy, nickel copper silicon alloy, nickel copper aluminium alloy, austenite corrosion-resistant steel.

2.2 Flame-retardant Materials The flame-retardant materials are those which do not transmit flame. They may partially burn out in the tests described below, but the length of the damaged portion resulting from burning shall be 60 mm or less.

(1) The test shall be carried out at normal temperature under windless condition.

(2) The test piece shall be a strip of 120 mm long or more, 10 mm wide and 3 mm thick.

(3) The test piece shall be suspended by thin metallic wire or the like with the longitudinal-axis-being inclined by 45° and the transversal axis being horizontally held.

(4) By using a Bunsen burner for city gas, flame shall be so adjusted that it may become vertical in the air with flame height being approximately 125 mm and its blue flame portion being approximately 35 mm, and the tip of the blue flame portion shall be applied to the lower end of test piece. Application of the flame shall be repeated five times at 15-second intervals, each being for 15 seconds at a time.

2.3 Double Insulation The double insulation means to provide an insulation for metallic operating parts, etc. in addition to the ordinary functional insulation in order to protect the human body from electric shocks caused by breakdown of the functional insulation of fittings.

3. Types of Fittings

3.1 Classification by Conditions of Installation The fittings shall be classified into the following types according to conditions of installation:

(1) Surface type: Surface type means such construction that fittings are installed on the surface of the ceiling or wall.

(2) Flush type: Flush type means such construction that fittings are partly or almost entirely buried in the ceiling or wall.

3.2 Classification by Waterproof Protection The fittings shall be classified into the following types in accordance with waterproof grades:

(1) Drip-proof type: There shall be found no sign of penetration of water considered detrimental when tested in accordance with Class 1 sprinkling test specified in JIS F 3001.

(2) Splash-proof type: There shall be found no sign of penetration of water considered detrimental when tested in accordance with Class 2 sprinkling test specified in JIS F 3001.

(3) Weather-proof type: There shall be found no sign of penetration of water considered detrimental when tested in accordance with Class 3 sprinkling test specified in JIS F 8001.

(4) Immersion-proof type: There shall be found no sign of penetration of water considered detrimental when tested in accordance with Class 1 or 2 immersion test specified in JIS F 8001.

4. Component

The components of fittings shall, as a rule, be as specified in Japanese Industrial Standards and suited for the purposes of fittings. As for materials and construction, 6 and 7 of this standard shall be applied. Main components shall comply with the following requirements:

(1) Lamp holder: Lamp holder shall be as specified in JIS F 8401 or the equivalent. The equivalent ones shall comply with the following requirements:

(a) Insulator shall be of porcelain, moulded synthetic resin, or the like.

(b) When any terminal is necessary, it shall be provided in a position that is free from electric shock.

(c) Conductive part having spring action shall be of phosphor bronze or beryllium copper.

(2) Lamps Lamp shall be as specified in JIS F 3407 with the exception of those with special requirements.

(3) Globe and frost guard The globe and frost guard shall be as specified in JIS F 3402, JIS F 3403, or the equivalent. The equivalent ones shall comply with the following requirements:

(a) Quality: Those of synthetic resin material shall have adequate strength and flame-resistant property so as to be free from detrimental deformation, softening, and other abnormal phenomena due to temperature rise at lighting during lighting.
Those of milk-white material shall have a high transmission factor and good lighting effect, and yet render it impossible to see the filaments of transparent lamps contained inside.

(b) Dimensions of fitting portions: As regards screw-type globe, dimensions of screw threads of globe holder shall conform to the requirements specified in the paragraph for thread and dimensions in JIS F 3402. As regards clamp-type globe, the dimensions of the clamp of globe shall, as a rule, be as shown in Figs. 1 to 3 of JIS F 3402.

(c) Luminous globe and transparent globe: Luminous glass or tempered glass to be used according to the purpose of fittings shall, as a rule, be as specified in JIS R 3205 or JIS R 3206.

(4) Shades: Shades shall be of metallic, or heat-resistant and flame-resistant material. For desk lamp, bracket, clean or the like may be used.

(5) Reflectors: Reflectors for projector requiring high reflectance specified shall be of aluminium sheet of purity of 99.8% or more which commercially produced.

(6) Terminal and terminal board: Terminal shall, as a rule, be as specified in JIS F 3811, and terminal board in JIS F 3812 or JIS F 3813.

(7) Cable glands: In gunmetal, Cable glands shall, as a rule, be as specified in JIS F 3808.

(8) Gasket and packing: Gasket and packing shall have an adequate hardness, and shall be of synthetic rubber of good quality with little ageing.

(9) Internal wiring: Internal wiring shall withstand temperature in fitting, and nominal sectional area of the wire shall, as a rule, be 1.25 mm^2 or more.

(10) Guards: In gunmetal, the guard shall, as a rule, be of round.

5. Corrosion-Preventive Treatment by Plating and Coating

5.1 Corrosion-Preventive Treatment for Non-Corrosion-Resistant Material: The corrosion-preventive treatment shall be applied to metallic parts other than those of corrosion-resistant material in accordance with the following requirements:

(1) Corrosion-preventive plating: Corrosion-preventive plating shall be such as nickel plating, nickel chrome plating, zinc plating, or cadmium plating, in any case, the film of the plating shall be fine, free from peeling off, and sufficiency thick to prevent corrosion caused by rain water, etc. On the surface of zinc plating or cadmium plating, treatment by chromate and or bichromate shall be applied.

(2) Corrosion-preventive coating and enamel film corrosion treatment: As regards general treatment, either epoxy treatment by resin-primer coating or equivalent treatment shall be applied to aluminium or aluminium alloy. To any casting other than aluminium and aluminium alloy, either resin-primer coating or phosphate treatment shall be applied.

(3) Preventive treatment for electrolytic corrosion in contact area between different metals: To the contact area between aluminium or aluminium alloy and metal of a different kind effective preventive treatment for electrolytic corrosion shall be applied by tape wrapping, etc.

5.2 Corrosion-Preventive Treatment for Corrosion-Resistant Material: Unless otherwise specified, corrosion-preventive treatment shall not be necessary for corrosion-resistant material.

5.3 Preservative Plating and Coating: Unless otherwise specified, preservative plating, coating, and paint colour may conform to the standards of manufacturers. Coating, however, shall be applied with flame-resistant paint (of such as phthalic acid, melamine group, etc.) of good quality.

6. Construction

The constructions of fittings shall comply with the following requirements:

(1) Fittings shall have sufficient mechanical strength against vibration, shock, and crushing, and also shall be compact, light and excellent in durability, and shall not cause a hazard to the operator and surrounding object.

(2) Fittings shall have sufficient internal volume for applicable lamps for lamps, and the components parts thereof shall be so arranged that temperature at the respective portions of fittings may not exceed the specified values.

(3) Fittings shall be of such a construction that allows easy and safe assembly, installation and maintenance.

(4) Lamp holder, terminal board, and wiring installed in fittings shall be sufficiently secured against vibration and shaking. For the screws serving such component parts, an effective locking means to prevent loosening shall be applied.

(5) Surfaces and edges of fittings and component parts shall be finished smoothly.

(6) Wood to be used for grip and pedestal of fittings shall be thoroughly seasoned hardwood, and shall be of such a quality that is free from quick deformation or cracking. Varnish shall be applied thereon.

(7) Fittings shall, as a rule, be set in at least two positions. For any fittings to be set in one position, a proper means to prevent turning shall be applied.

(8) Setting portions of fittings shall be capable of maintaining sufficient strength for mechanical and electrical safety of the fittings even when external force is applied during use. Dimensions of setting holes of fittings shall conform to the third grade of JIS B 1001, and shall be as given in Table 1.

Table 1

Size of bolt	Diameter of hole
4	4.5
5	5.5
6	7
8	10
10	12
12	15

(9) Bracket of bracket type fittings shall have a sufficient strength.

(10) Porcelain-made lamp holder shall be set in at least two positions. It is recommended that such lamp holder be set through hard fiber or synthetic rubber, not directly by screws.

(11) Such fittings requiring the function of directing up and down and slewing as projector, cargo light, or boat deck lamp shall be of such a construction that allows easy and smooth operation, and shall be free from loosening by knock or the like after being fixed.

(12) In order to avoid undesirable thermal effect, the fittings may be provided with ventilation opening, reflecting device, shading plate, etc.

Ventilation opening to be formed on the fittings shall comply with the following requirements:

(a) Ventilation opening shall not be such that decreases the strength of fittings.

(b) Ventilation opening shall not exceed 9.5 mm in width in case of a slot, or 12.5 mm in diameter in case of a hole so as to keep rat-proof construction.

Table 2

Wattage of lamp: W	Clearance: mm
Up to 60	5 or more
Exceeding 60 up to 100	7 or more
Exceeding 100 up to 200	10 or more
Exceeding 200	20 or more

(13) Globe and frost glass shall be easily replaced, and glassware shall be set through synthetic rubber, felt, or the like.

(14) Methods for leading in and connecting external cables shall comply with the following requirements:

(a) Connection of external cables with fittings shall, as a rule, be made at the terminal board provided in the fittings.

(b) Clearance between terminal board and cable inlet shall be 40 mm or more in principle so that external cables may be easily terminated and handled.

(c) Cable inlet hole to be formed on light shall be finished smoothly or shall employ bushing so as to prevent damage to the cable.

(d) When watertight construction is required for cable inlet, cable gland shall be provided in accordance with 4 (7).

(e) When using flexible cord for portable type fittings, it shall be of such a construction that permits accepting a protective rubber like sheath specified in JIS F 8806.

(f) Portable type fittings shall be provided with external cable clamps so that external force may not be applied directly to terminals. Cable glands may be used instead of cable clamps.

(15) Fittings such as desk light, light for machining work, or dispensary light shall be so constructed that cables may not be damaged due to the movement of flexible joints, etc.

(16) Fittings whose rated voltages are 50 V or more shall be provided with an earthing terminals at suitable position, or shall be of such a construction that allows earthing by some other means.

(17) Fittings provided with anti-vibration device shall be free from such troubles as caused by resonance.

(18) Fittings having a device for adjusting light source position shall be of such a construction that allows smooth and easy adjustment, and shall be free from such deviation in adjustment as caused by vibration.

(19) Fittings such as desk light or floor stand light shall be of such a construction that is free from slipping or falling when placed on a plane inclined by 22.5° with respect to the horizontal plane.

(20) When cloth or the like is used for a shade, the fittings shall be of such a construction that is capable of maintaining sufficient clearance between shade and lamp.

(21) Special parts such as grip of portable hand lamp shall be of a double-insulation construction, if necessary.

(22) Portable type fittings shall, as a rule, be provided with guards so as to protect lamps or globes.

(23) Fittings to be used in places where mechanical damage might be caused shall be provided with guards.

(24) Guard shall be of such a construction that allows easy mounting or dismounting, and shall be fixed securely so as not to fall due to vibration, etc.

(25) Such fittings that might leak light through any part other than the light transmission part shall be provided with a shading plate, if necessary.

(26) When a receptacle is provided on wall type fittings such as water-proof mirror light, a blind cap shall be attached. The blind cap shall be securely connected to fittings by means of chain, etc.

(29) The minimum insulation distance on fittings shall, as a rule, be as given in Table 3. When non-conductive sheath is provided on fittings, however, the air gap shall be made smaller by taking the assurance of thereon into consideration.

Table 3

Unit: mm

Rated voltage V	Between live part and earth or conductive metal		Between live part and part to be insulated	
	Air gap	Creeping distance	Air gap	Creeping distance
Up to 25	3	4	4	4
Exceeding 25 up to 250	3	4	6	6

(30) The temperature rise of terminals of external cable connections shall not exceed the following values, when the maximum applicable loads or lamps are lighted at the rated voltage in accordance with the testing methods specified in JIS F 8002, and the temperature reaches the permanent point.

Reference ambient temperature	Temperature rise
45°C	30°C [50K]
40°C	25°C [25K]

(31) Maximum temperature for the knob or handle of light switch shall be 60°C or less.

(32) The fittings of watertight construction used on weather deck are lighted with the maximum applicable lamp or lamps at the rated voltage under normal lighting conditions. Until the maximum temperature of each part is attained. After that, when water of a lower temperature (maximum 5°C) than the ambient by 10°C [10K] is poured, there shall be no cracks in each part.

(33) Fittings whose light distribution is specified in accordance with performance shall conform to such standard when the light distribution is measured with applicable lamp being lighted at rated voltage.

(34) As for insulation resistance of fittings when measured with a 500 V DC insulation resistance meter, the insulation resistance between different poles and between live part and dead metallic part shall be 2 MΩ.

(35) As for dielectric strength of fittings, a test voltage of approximate sine wave form at a commercial frequency shall be applied between different poles and between live part and dead metallic part, and after the voltage shall be increased up to the values given in Table 4, the parts shall withstand the voltage for one minute.

Table 4

Unit: V

Rated voltage	Test voltage
Up to 50	500
Exceeding 50 up to 250	1500

2. Materials

The materials shall, as a rule, be as specified in Japanese Industrial Standards, and shall be of good quality to withstand long use even under ambient, chemical and electrical properties as required under normal use of fittings and fixtures, shall comply with the following requirements. Any commercially approved materials such as wood or the like shall, in principle, not be used.

(1) Metallic materials — In principle, the metallic material shall be of corrosion-resistant property. When using non-corrosive-resistant material, some treatment as mentioned in 5.1 shall be required.

(2) Synthetic resin materials — When using the synthetic resin material instead of the metallic material, it shall have adequate mechanical strength and the least possible ageing as well as oil-resisting, heat-resisting, and weather-proof properties.

(3) Insulating materials — The insulating material shall be of heat flame-retardant, and shall have adequate mechanical strength and electric characteristics as well as moisture-resistant, oil-resisting, and heat-resisting properties removed according to conditions of the place for use.

(4) Condensation resistant — The condensation resistant shall be copper or copper alloy.

3. Marking

Necessary items shall be suitably marked in accordance with the respective standards over conspicuous place of the fittings.

Name plate to be used for marking shall be of brass, aluminium, or plastic, and shall be fixed by means of screw, rivet or adhesive agent.

Reference Standards:

JIS B 1051 — Dimension of Bolt Hole and Countersink
JIS F 3083 — Method of Waterproof Testing for Marine Electric Appliances
JIS F 8002 — General Rules on the Temperature Test of Electric Lighting Fittings (Incandescent Lamps) for Marine Use
JIS F 8401 — Lamp Holders for Marine Use
JIS F 8402 — Glass Covers for Marine Electric Light
JIS F 8403 — Frame Guards for Marine Electric Light
JIS F 8407 — Marine Lamps
JIS F 8501 — Marine Watertight Cable Glands for Electric Appliances
JIS F 8806 — Protective Rubber-like Sheaths of Portable Cord for Marine Use
JIS F 8811 — Solid Size Terminals for Marine Use
JIS F 8812 — Electric Terminal Blocks for Marine Use
JIS F 8813 — Crimp Terminal Sockets for Marine Use
JIS R 3205 — Laminated Glass
JIS R 3206 — Tempered Glass

RECOMMENDED
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LONG-RANGE PLAN

VOLUME II

.APPELNDIX II-D)

EXAMPLES OF SYSTEM CODES

APPENDIX II-D

EXAMPLE OF SYSTEM CODES

(Example)

Committee Code | Technical Sub-Comm. Code | System Code | Item Code

Technical Sub-Committee Code	System Code	Item
0 1 (Material)	0 1	Steel
	0 2	Non-Ferrous Metal
	0 3	Non-Metal
	0 4	Testing
	...	
	...	
	9 9	Miscellaneous
0 2 (Coating)	0 1	Painting
	0 2	Insulation
	0 3	Deck Composition
	...	
	9 9	Miscellaneous
0 3 (Outfitting)	0 1	Masts, Derrick Posts
	0 2	Doors, Closing Appliances
	0 3	Outboard Fittings
	0 4	Ladders, Hand rails, Awnings, Canvas Covers
	0 5	Communication, Navigation Equipments
	0 6	Life Saving Equipments
	0 7	Galley, Sanitary Equipments
	0 8	Fire Fighting Equipments
	0 9	Anchors, Anchor Cables
	1 0	Cargo Blocks, Ropes, Shackles
	1 1	Accommodation Joiner Work
	...	
	2 1	Air Conditioning System
	...	
	9 9	Miscellaneous

Technical Sub-Committee Code	System Code	Item
0 4 (Hull Structure)	0 1	Hull Structure, General
	0 2	Large Casting & Forging
	0 3	Auxiliary Machinery Seats
	0 4	Special Steel Structures
	...	
	9 9	Miscellaneous
0 6 (Ship Control & Automation)	0 1	General (Inspection, etc.)
	0 2	Automatic Control, Engine Room Remote Control System
	0 3	Machinery & Navigational Measurement Instruments
	0 4	Electric Noise, Environment Conditions
	...	
	9 9	Miscellaneous
0 7 (General Support Requirements)	0 1	General
	0 2	Symbols, Terminology, Units, Marks, etc.
	0 3	Engineeing, Production, General
	0 4	Testing, Inspection
	...	
	9 9	Miscellaneous
0 8 (Deck Machinery)	0 1	Steering System
	0 2	Mooring System
	0 3	Cargo Handling System
	0 4	Windlass
	...	
	9 9	Miscellaneous
1 0 (Electric & Electronics)	0 1	Electric Outfitting, General
	0 2	Generator System
	0 3	Electric Motors, Heaters
	0 4	Lighting & Signal Lamps
	0 5	Electric Communication, Electric Navigation Equipment

Technical Sub-Committee Code	System Code	Item
1 0	0 6	Wireless Telegraph System
(Cont'd)	0 7	Cables
	0 8	Distribution Fittings
	...	
	9 9	Miscellaneous
1 1	0 1	Machinery Outfitting, General
(Machinery)	0 2	Main Engine, General
	0 3	Shafting, Propeller, Reduction Gear
	0 4	Boiler, General
	0 5	Burner, Uptake, Funnel & Attachments
	0 6	Auxiliary Machinery, General
	0 7	Aux. Machinery Prime Movers, Pumps, Air System, Purifiers
	0 8	Heat Exchangers
	0 9	Miscellaneous Tanks
	1 0	Access Arrangement (Gratings, Ladders, Floors)
	1 1	Invetories, Tools
	...	
	9 9	Miscellaneous
1 2	0 1	General (Inspection, Qualification of Welders,etc.)
	...	
	9 9	Miscellaneous
1 3	0 1	Pipe Outfitting, General
(Pipe System)	0 2	Basic Components (Valves, Flanges, Joints)
	0 3	Hull Piping System
	0 4	Machinery Piping System
	0 5	Accessories
	...	
	9 9	Miscellaneous